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BY OPERATION, &c.

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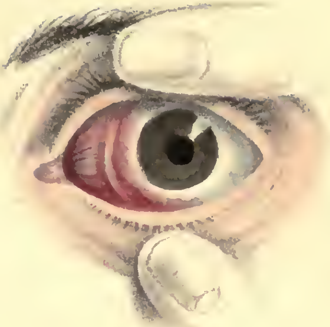

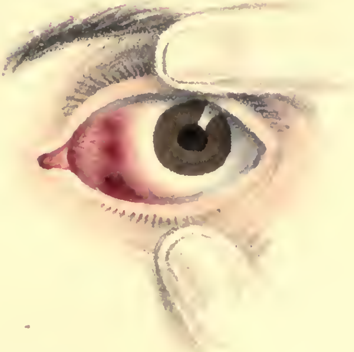

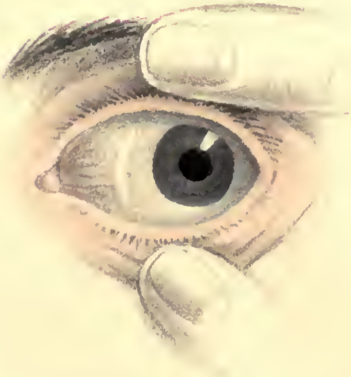

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THE CURE
OF
Strabismus, or Squint,
BY
OPERATION,
AND BY MILDER TREATMENT;
WITH
SOME NEW VIEWS OF THE ANATOMY AND PHYSIOLOGY OF THE MUSCLES OF THE HUMAN EYE.

By P. BENNETT LUCAS,

Member of the Royal College of Surgeons in London; Licentiate of the Royal College of Surgeons in Ireland; Lecturer on the Principles and Practice of Surgery at the Hunterian School of Medicine; one of the Surgeons to the Metropolitan Free Hospital, &c.

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PREFACE.

To Professor Dieffenbach, of Berlin, belongs the merit of being the first surgeon to put into operation the division of muscles for the cure of deformities of the human eye.

The first intimation I had of Professor Dieffenbach's operations, was through Dr. Forbes's *British and Foreign Medical Review*, where a short account was given of three cases in which the inner rectus muscle had been divided for the cure of squint, with the most satisfactory results.

I anxiously availed myself of the first opportunities to put this interesting operation into practice; and whatever merit attaches to the fact of being the first surgeon to perform it in this country, that merit I humbly yet distinctly claim.

My first operation was performed on April 7th, 1840, in which I was assisted by Dr. Hingeston and Mr. Wardrop, jun. My second operations were performed on April 11th, 1840, in which I was assisted by Mr. Fitzmaurice, Mr. Wardrop, jun., and Mr. Alexander.

These cases, and numerous others, with observations, I have laid before the profession through the pages of the *Lancet*.

In these communications I have faithfully detailed the different steps of the operations I have performed, the result of those operations, and the improvements I effected in the original operation of Professor Dieffenbach; and my anxiety that no particle of originality or of merit should be lost to Professor Dieffenbach, is best evinced by the following extract from my third communication: "If, in "the course of my experience to this date, June 20, "in thirty-two cases, I have deviated from the "rules laid down by this eminent surgeon, I was "guided, not by a wish to arrogate to myself any "credit for originality or innovation, but by the "necessity arising in the cases themselves for "other auxiliaries."

In the account of Professor Dieffenbach's operation it was stated that "the eye-lids were kept "apart with two hooks by an assistant. The "operator then passed a third hook, which he "gave to an assistant to hold, through the con-"junctiva, and to some depth in the subjacent "cellular tissue at the internal canthus. He next "fixed a fine double hook in the sclerotica at the "inner angle, and, taking it in his left hand, drew "the eye outwards. Then cutting into the con-"junctiva close to the ball, where it is continued

" from it to the internal canthus, and penetrating " more deeply by separating the cellular tissue by " the side of the sclerotica, he divided the internal " rectus muscle close to its insertion with a fine pair " of scissors."

On this operation I appended the following observations to some cases which appeared in the *Lancet.*

" As will be observed, on the perusal of the " foregoing cases, and of those which have appeared in the *Lancet* of April 18th, the operation which I have now successfully employed in " five cases, differs in many, and I would say " essential, particulars from that adopted by " Professor Dieffenbach ;—indeed, when I first " attentively considered the details of the three " cases as reported in the *British and Foreign* " *Medical Review,* I was struck with the " number of hooks which were employed, and " the necessity arising therefrom for many assistants, who in all operations—but especially in " operations upon the eye—too often interfere " with each other, and with the operator.

" In Professor Dieffenbach's operation no less " than four hooks are employed, and one of these " a double one ; two for the purpose of keeping " the eye-lids apart, a third is passed into the " conjunctiva, and the fourth, the double one, is " fixed into the sclerotica. In none of the cases, " with the exception of Catherine Culbert's, did " I use more than one hook ; and in the case of

" the child, Mary Anne Daly, I used *none*, having " divided the conjunctiva with a knife and forceps. " This latter instrument I have since found is not, " for many reasons, to be depended upon as much " as the hook; it gives more uneasiness to the " patient, and is apt to lose its hold of the con- " junctiva, which the hook never does, until it is " intentionally removed."

In the description of the operation in the following pages I have endeavoured to make its different steps as plain as words permit, which at best are but poor substitutes for the appearance which they present during its performance.

It will be seen that the greatest improvement in the operation is the passage of a blunt instrument beneath the muscle, by which the sclerotic coat is in no danger of being wounded, and which gives the operator perfect command over the muscle and the eye-ball.

In the first operation which I performed, my friend, Dr. Hingeston, suggested to me to bend a common probe for this purpose, and which succeeded so well, that I gave directions to Mr. Weiss to make the blunt hook, which I have since used. A description of it was published in the *Lancet* more than four months ago, and since that time various modifications have been made of it, according to the taste of the operator.

Since that time the letters I have received from professional friends, in testimony of the utility of this simple instrument, as well as of my simplification of Professor Dieffenbach's original operation, have been many, and afford the best practical evidences that such improvements were required.

Dr. William Vesalius Pettigrew, who has operated on seven cases of strabismus, and who has assisted me in many, thus writes :—" The instru-
" ments I used were similar to those which I have
" seen you so dexterously operate with upwards
" of twenty times, viz., a pair of scissors, one
" sharp hook, and one blunt hook ; this latter in-
" strument I had, acting upon your suggestion,
" flattened at the sides and a little more curved,
" and find that it answers most admirably ; for all
" the fibres of the muscle can be brought under
" the hook, and divided at one cut."

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Pl. 2

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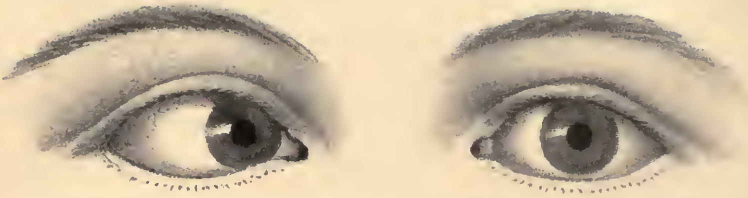

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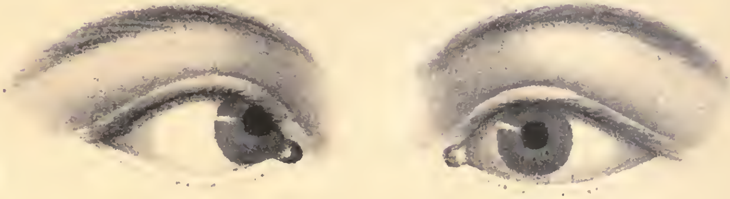

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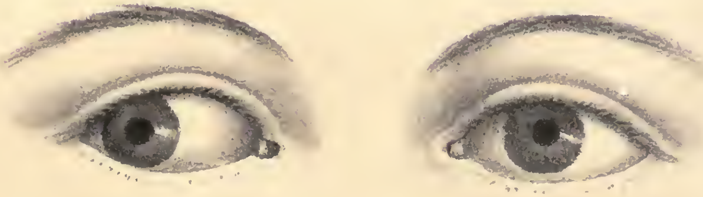

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PLATE I.

Fig. 1.—SINGLE CONVERGENT STRABISMUS.

Fig. 2.—DOUBLE CONVERGENT STRABISMUS.

Fig. 3.—DIVERGENT STRABISMUS.

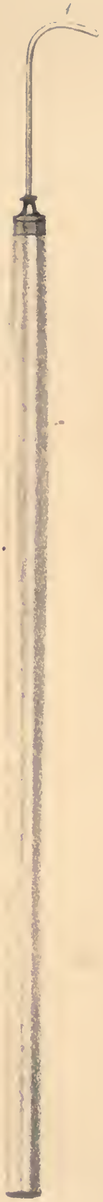
PLATE II.

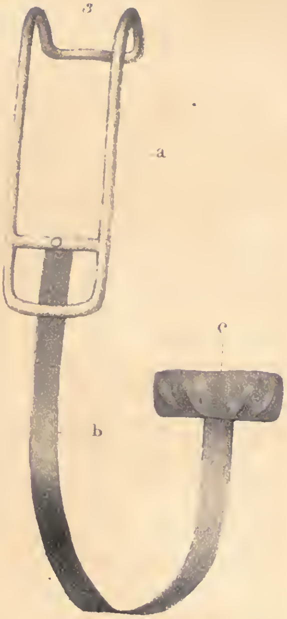
REPRESENTS THE APPEARANCES OF THE EYE AFTER THE OPERATION, AT DIFFERENT PERIODS.

FIG. 1.—THE EYE, SIX DAYS AFTER OPERATION.

FIG. 2.—THE EYE, WITH GRANULATIONS AFTER THE OPERATION, AS SOMETIMES TAKES PLACE.

FIG. 3.—THE EYE, FOUR WEEKS AFTER OPERATION.





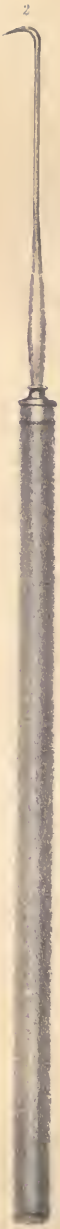


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PLATE III.

Figs. 1 & 2.—THE SHARP AND BLUNT HOOKS.

Fig. 3.—THE DEPRESSOR FOR THE LOWER LID.

- *a.*—THE CURVED WIRE WHICH FITS ON THE LID.
- *b.*—THE SPRING.
- *c.*—THE PAD.

A

Practical Treatise

ON THE

CURE OF STRABISMUS

BY OPERATION, &c.

The eyes, in man, are situated at the superior and lateral parts of the face, for obvious purposes; they are contained in two bony cavities, called orbits, to the size of which they hold but a small proportion. It is necessary for the full and proper consideration of the more immediate objects of this treatise that the anatomical construction of these osseous cavities be generally examined.

OF THE ORBITS.

Each orbit is of a pyramidal form, the apex being directed backwards and inwards, and the base, which is irregularly quadrilateral, being directed forwards and outwards.

Seven bones enter into its formation, the most delicate and brittle of which, viz., the os unguis, or lachrymal bone, and the pars planum of the ethmoid bone, are situated internally. On examining the base of the orbit it will be found that its external edge is the shortest, and at the same time the strongest, and that the direction of the outer wall of the cavity from this margin is obliquely inwards, presenting a plane flat surface to the apex. The upper and lower edges of the base are next in degree of strength, are better defined, and the walls of the cavity, which precede from these margins of the base, are at their commencement very concave, particularly above, and do not assume a planiforme appearance until they approach the apex; indeed, after the inferior wall has proceeded half way it becomes decidedly convex, and, after this, passes to its termination. The inner boundary of the base is the longest, and although it is well defined at its upper half, where the internal angular process of the frontal bone forms it, yet at the lower half it presents some irregularity, arising from the necessity which here exists for giving a secure and bony protection to that portion of the lachrymal apparatus, called the lachrymal sac. At this part of the base two sharp prominent edges present themselves, enclosing an oval concavity for the lodgment of the lachrymal sac; the most posterior of these edges divides the os unguis into two parts, and is directly continuous with that portion of the frontal bone which forms the upper half of the internal margin of the orbital base. This edge of the os unguis I shall consider as part of the true inner boundary of the base of the orbit, and shall look upon the inner and upper edge of the superior maxillary bone as subservient to the protection of the lachrymal sac, and afterwards, by its junction with the frontal bone, as forming one of the strong points of connection between the bones of the face and those of the cranium. From this inner boundary, formed by the angular process of the frontal bone and the edge of the os unguis, the most delicate wall of the orbit proceeds directly backwards, with a slight degree of convexity, both vertically and antero-posteriorly; it runs nearly parallel with the corresponding part of the other cavity, and is formed by the brittle and thin parts of the os unguis and ethmoid bones, being completed and strengthened behind, or at the apex of the orbit, by part of the body of the sphenoid bone.

At the junction of the upper and the inner margins of the orbital base a slight depression exists, and in some a small spine of bone. The interest which obtains to this point arises, from its giving attachment to a tendinous pully, through which one of the muscles of the eye, the superior oblique, passes, for the purpose of determining its due action; and more external to this depression or spine, approaching the centre of the upper margin of the orbital base, is to be detected a foramen, or a notch, and occasionally both, which derive their importance from transmitting the frontal nerve and artery. With the exception of the depression already alluded to for the lodgment of the lachrymal sac, no other points in the base of the orbit are of sufficient moment to demand attention.

The walls of the orbit derive additional interest from the foramen they present, and some other anatomical peculiarities which I shall next proceed to examine. On looking into the orbit two fissures will be observed, which run into each other at its apex. The narrowest and longest of these is situated inferiorly, the spheno maxillary fissure, occupies somewhat more than half the depth of the cavity, and separates its inferior from its external wall; the second, which is broader and situated much more posteriorly, separates the external from the superior wall, and receives the name of sphenoidal fissure or foramen lacerum. No well defined mark can be pointed out as defining the boundaries of the inner wall from either the superior or inferior walls, if the small internal orbital foramina and the optic foramen be excepted.

The sphenoidal fissure gives passage to the principal nerves which go to the appendages of the eye and to the ophthalmic ganglion, viz., the third, the fourth, the ophthalmic division of the fifth and the sixth ; it is also the passage by which the ophthalmic vein returns from the orbit to pour its contents into the cavernous sinus. Situated internal to the sphenoidal fissure is the foramina opticum, with its aspect forwards and outwards, and which exists for the purpose of transmitting the optic nerve and the ophthalmic artery. A narrow process of bone separates the foramen opticum from the sphenoidal fissure, and gives attachment to three of the recti muscles by a common tendon. Of the internal orbital foramina, which have been mentioned, one is anterior and the other posterior; they both transmit a small branch of the ophthalmic artery, and the anterior one also gives passage to a filament of the nasal division of the ophthalmic branch of the fifth nerve.

Immediately behind the junction of the superior maxillary bone with the malar bone, where they unite to form the lower margin of the base of the orbit, a slight depression exists, for the origin of the inferior oblique muscle of the eye, which will again be spoken of ; and within the external angular process of the frontal bone, where the external and superior walls of the orbit run into each other, is the fossa for the lodgment of the lachrymal gland.

The orbit formed of seven bones united to each other by delicate sutures, is lined by a periosteum, which is continuous with the dura mater at the foramen lacerum.

The size of each orbit is considerably larger than the globe of the eye, which it contains and protects; this arises in consequence of its lodging other parts, which are essential to the economy of the organ of vision, such as the muscles which move the eye, the blood vessels which nourish it, the nerves which supply its muscles, the optic nerve itself, the lenticular ganglion and its branches, the absorbents, the lachrymal gland, and masses of soft yielding fat, with cellular tissue. It will not be necessary to enter into a minute anatomical detail of all these several structures; I shall therefore proceed to consider the anatomy and physiology of the muscular apparatus by which the movements of the globe of the eye are effected, and shall only dwell upon any of the other parts I have enumerated, in so far as they are concerned, in operation upon the muscles, by their proximity to them. Before doing so, however, the construction of the orbits for the purpose of securing an extensive field of vision, cannot be passed over. It has been seen that each of these cavities is of a conical form, the base being anteriorly, and by its great size, in comparison to the globe of the eye, that it freely permits the latter to roll about in all directions. But in order to insure a wide range of vision in the lateral direction, and even somewhat posteriorly, the axis of each orbit is directed forwards and outwards, and the external margin of its base inclines considerably backwards.

If the head be fixed, and the face directed forwards, the great extent of vision, laterally, can be readily ascertained by directing either eye outwards, when objects placed parallel to our own side will be at once brought into view, and also objects placed to some distance behind this point. If it be desired to take a wider field of vision posteriorly, then another provision is brought into play, viz. the motions of the atlas upon the axis, by which the head turns; and were it not for the outer wall of the orbit being an oblique plane, and its edge holding the position it does, we could only take cognizance of objects placed laterally to us by these motions of the head upon the trunk.

In taking a comparative view of the form of the orbits in the lower orders of animals, we find this provision for the ensuring of vision in the lateral and posterior directions most remarkable.

In some animals these cavities are placed so much at the sides of the cranium that their axes are in the same transverse line. In others, as the carniverous tribes, the cranium is situated between the orbits, not as in man above them, and their axes, in consequence, meet at a considerable angle.

The orbits of the hare, which are remarkable for their great size, allow the eyes of this animal to be so directed as to take with ease into their field of vision objects placed not only laterally, but posterior to them; and in the horse, so extensively is the power of thus directing the eyes permitted, that we limit their exercise by placing blinkers upon them.*

ON THE MUSCLES OF THE EYES.

When the anatomy and physiology of the muscles, which are destined to effect the movements of the eyes,

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* These bony cavities present many peculiarities in different individuals: sometimes they are very large, and are widely separated from each other; at other times they will be found small, and to approach each other. Their circumferences, or bases, are mostly beveled off at their external margins, by which the field of vision is considerably increased in the lateral directions; but I have, in some instances, seen the contrary to this, and have found that lateral vision was very much impeded by the outer margins being too projecting. In one case of convergent strabismus of both eyes, the orbits were remarkable for this conformation. The eyes were small, dark, and rather sunken, and the patient could not take cognizance of objects placed laterally without turning the head. The breadth from one external angular process of the frontal bone to the other was unusually small, and the outer margins of the orbits projected as much as the upper and lower margins.

A black subject was received at the dissecting-room in the year 1835, in which the distance from one superior spine of the ilium to the other did not very much exceed the distance of the external margin of one orbit to the other! The following are the measurements of the body, taken from my note-book for that year:—Height, 5 feet 9½ inches; circumference of the base of the thumb, 2⅜ inches; ditto of wrist, 5 inches; ditto of centre of arm, 8½ inches; ditto of neck, 13 inches; ditto of upper part of the chest, 31 inches; ditto of great toe, 2⅛ are considered, it is at once revealed to us that the causes which produced their abnormal actions, and upon which strabismus depends, must be very numerous, and have their origin in a variety of sources.

The muscles destined to move the eyes are six in number. Of these, four are called recti, or straight muscles, and two oblique. The four straight muscles are attached at the apex of the orbit, and from this point they advance forwards, gradually separating from each other until they arrive at the globe of the eye into the sclerotic coat of which they are inserted.

These four recti muscles are distinguished according to the position they hold to the eye-ball, into superior, inferior, external and internal; and their individual actions are plain, and are easier of demonstration in the dead subject than probably any other muscles of the human body. The superior rectus muscle turns the eye upwards, and from the peculiar expression given to the countenance by its action, it was called the musculus superbus by the ancients; its antagonist, the inferior rectus, turns the eye downwards, and was called, in consequence, the musculus humilis; the external rectus rolls the eye outwards, and hence it received the name of musculus indignatorious; and the internal rectus rolls the eye inwards, and received the name of musculus bibatorious, from the direction it was supposed to take in the act of drinking. The individual actions therefore, of these muscles, were as well known to the ancients as they are at the present day.

The operation, however, of two or more of these muscles upon the eye has been a question involved in some discussion; for although it was universally allowed that any two of the recti muscles next each other, when

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inches; ditto of ankle, 6½ inches; ditto of thigh, 14¼ inches; distance of one superior spine of the ilium from the other, 7¼ inches; ditto of one external angular process of the frontal bone from the other, 5½ inches.

acting together, could draw the eye in their diagonal, yet it has been contended, on the one hand, that the conjoint action of all was to draw the eye within the orbit; and on the other, to have the very contrary effect. Distinct actions also of parts of the recti muscles have of late been attributed to them, to account for certain phenomena which present themselves after the inner rectus has been divided, for the cure of convergent strabismus.

The two oblique muscles are very remarkably opposed to the four recti, and like them, from the position they hold to the eye, are called superior and inferior. The inferior oblique is attached to the anterior part of the orbit, or to the base of the cone, and the superior oblique, although arising from the apex of the orbit at the same point with the recti, virtually acts from the base of this cavity, in consequence of its tendon before its insertion, passing through a pulley, which completely alters its original direction. Both oblique muscles therefore may be said to take a direction, from before, backwards to their insertion into the sclerotic coat of the eye. The action of the inferior oblique is to direct the eye upwards and inwards, and that of the superior oblique to direct it downwards and slightly outwards. When both these muscles act, they draw the eye forwards, and direct it inwards; but their principal action is to draw the eye forwards, and the direction which they give it inwards belongs to the inferior oblique chiefly.

From these demonstrable facts, the obliqui muscles are antagonists to the four recti, inasmuch as their combined action is to draw the eye forwards, whilst that of the four recti is to draw it backwards; and the inferior oblique also co-operates with the internal rectus muscle, in drawing the eye inwards, thus antagonising the external rectus. When traction is made on the external rectus muscle in the dead subject, so as to draw the eye as much outwards as possible, by making traction upon both oblique muscles, the eye will be drawn towards the inner angle of the orbit, but there their antagonism to the external rectus muscle ceases. In order to turn the eye still deeper, so as to conceal a greater portion of the cornea within the canthus, traction must be made upon the internal rectus muscle.

The actions of the two oblique muscles, however, are rather designed to antagonize the actions of one or of two of the recti muscles, than the actions of the four recti combined. Indeed the power which the four recti muscles possess, of drawing the eye within its orbit, is very limited. It is seldom that we are called upon to protect our visual organs by such a contrivance; they are defended from external injury by other and surer means, such as by the motions of the eye-lids, by the natural prominences which surround the orbits, and by the position which our upper extremities hold to them. Besides, the other parts which the orbits contain do not yield sufficiently to allow the eye to be retracted to any very marked degree; and, beyond defending the eyes from external violence, the utility of such a movement is not very apparent; it cannot produce any effect upon the optical apparatus of the eye, as the globe is moved *en masse* without altering its form or changing the respective position of its transparent media to each other, and we possess a better apparatus for placing the eyes close to an object, or removing them from it—viz. that by which the motions of the head upon the trunk are performed.

When any one of the recti muscles acts, it will not only turn the cornea in the direction of its fibres, but by increasing its contraction, will also draw the eye more or less within its orbit. The internal rectus muscle has the greatest power of producing this latter action, and the external muscle next; the power which the superior and inferior recti muscles have in this way, is scarcely appreciable. On the eye-ball being thus partially retracted, the other contents of the orbit, particularly the large masses of fat, do not offer any opposition to such a movement, as they do when the four recti act; these parts give way, or are displaced in the same manner as we find the fatty bodies contained in the articulations to be when the joints are moved; and when the eye is again drawn forwards, the masses of fat resume their original position.

If the eye-ball be thus retracted by the action of any of the recti muscles, the antagonising rectus muscle will be placed in a most unfavourable way to restore the organ to the position it was moved from. Thus, to take the best example in illustration, let us suppose the eye to be drawn deeply inwards, by the inner rectus muscle, so as to conceal a great part of the cornea — an action which this muscle is perfectly capable of performing in the healthy state — the external rectus muscle would be incapable of turning it outwards, were it not that the eye-ball was again drawn forward; but this being accomplished, the external rectus muscle is then most favourably situated for its action.

To accomplish this end, the oblique muscles are admirably situated. It has been shown that these muscles are capable of directing the eye-ball as far as the inner angle of the orbit, but not of turning it deeply inwards; when, therefore, this latter action is performed by the inner rectus muscle, the oblique muscles become antagonists to it, and, acting from prominent points at the base of the orbit, they are enabled to withdraw the eye-ball from the inner recess of this cavity, and to place it in the most favourable way for the external rectus muscle to draw it outwards.

In the like manner when the eye is turned to its utmost outwards, the oblique muscles have the power of drawing it forwards and inwards, so as to place the organ in the most favourable position for the inner rectus to perform its special action.

This view of the action of the oblique muscles antagonizing one of the recti muscles only, or two of them, when the eye is drawn in their diagonal, explains why they are only two in number, when the recti are four in number — why, in creatures where the eye is socketed on a cup of cartilage, and cannot retract, the oblique muscles are nevertheless present — why, where a powerful retractor muscle is bestowed, in addition to the recti muscles, the oblique muscles have no additional magnitude given to them — and why they stand contrasted in size with the four recti muscles taken together, but not with a single rectus muscle.

The oblique muscles also co-operate in their actions with the orbicular muscle which closes the eye-lids in the act of winking. If the finger be placed on the upper eye-lid, so as to feel the globe of the eye beneath it, and if the act of winking be imitated, the eye will be felt to be drawn inwards.

By both these movements, occurring as they do involuntarily, the fluids destined to moisten the anterior surface of the eye-ball are diffused equally over its surface, and are at the same time directed inwards towards the patulous orifices of the lachrymal canals. It is by this provision also, assisted by the horizontal movement of the lower eye-lid, that a foreign body, when it gets between the eye-ball and its lids, is, if not removed, ultimately deposited at the inner canthus of the eye; and that the minute particles of dust which lodge during the day upon the surface of the eye-ball, are, after a time, collected together in the same situation.

Besides the actions which I have already ascribed to the four recti muscles—viz., that of their individually drawing the eye in the direction according to which they are placed, or of collectively drawing the eye within the orbit, or in the diagonal of any two muscles placed next each other, they are also capable of effecting other actions. Traction upon the innermost fibres of the superior and inferior recti muscles directs the eye inwards, and traction made upon their external fibres directs the eye outwards, but not to the same degree in this direction as the other fibres do inwards. It is quite clear from such experiments, that when the internal rectus muscle is divided for the cure or relief of convergent strabismus, that the power which the individual afterwards has of directing his eye inwards, is not only owing to the operation of the oblique muscles, but also to the inner fibres of the superior and inferior recti.

There is another muscle contained within the orbit, which is destined for the elevation of the upper eyelid; and, as it is supposed by some to exercise a secondary influence on the motions of the eye-ball, its description is here called for.

This muscle, the elevator of the upper eye-lid, is situated the highest of any within the orbit: it is attached by a narrow tendon to the edge of the foramen opticum at its upper part, and passes forwards. It becomes broader as it approaches the anterior part of the eye-ball, and bending over it in front, it terminates in a thin tendinous expansion, which is inserted into the convex edge of the tarsal cartilage.

From this muscle passing over a considerable portion of the upper and back part of the eye-ball, and the origin and insertion of the muscle being under the highest convexity of the ball, that body must be pressed forwards in proportion to the resistance of the upper eye-lid to rise; hence Sir Charles Bell's opinion is that, at the time the upper eye-lid is being raised, the eye-ball is pushed outwards, and the lower eye-lid, from its adaptation to the convex surface of the ball, slips off it, and is consequently depressed.

The varied movements which one eye is capable of performing in the living subject are easily demonstrated upon the dead by the experiments I have just given an account of; but, to perform these movements, some of the muscles are most advantageously situated, and others most disadvantageously. Of these advantageously situated, none is more so than the internal rectus muscle; and, on the contrary, none is less so than its antagonist, the external rectus. It has been stated, that all the recti muscles take their origin around the apex of the conical orbit, and proceed from this point to the eye globe which it is their object to move; but the axis of the orbit and the axis of the eye-globe do not correspond, that of the orbit being directed considerably forwards and outwards, and that of the visual organ which it contains being directed forwards; the consequence of which is, that the inner rectus muscle advances in the most favourable direction to effect its purpose—viz., directly forwards, whilst the external rectus muscle has to make a considerable curve before it reaches its insertion, and in consequence, as opposed to its antagonist, acts most disadvantageously.

The two oblique muscles also, like the internal and external recti, obtain opposite degrees of advantage in their actions from the course which they take. The inferior oblique, a short strong muscle, passes from before backwards, in the most favourable manner to effect its actions, whilst the superior oblique muscle pursues a long course from behind forwards, and then, to effect its appropriate action, has to turn itself by means of a pulley from before backwards.

The superior and inferior recti muscles are fair antagonists to each other arising from the apex of the orbit, and passing forwards to be inserted into the sclerotica, the one above and the other below, and both most favourably situated for the simple actions they have to perform, of directing the eye, when one acts, upwards, when the other, downwards; and, when both act together, of drawing the globe backwards.

ON THE MOVEMENTS OF BOTH EYES AND THE MOTOR NERVES.

When the movements of both eyes are made the subject of investigation, they do not admit of the same satisfactory method of demonstration as the movements of one of these organs, and the harmonious actions which they observe, call for another method of investigation, besides that of making traction upon their fibres in the dead subject. In writing at the present moment, my eyes are directed downwards and inwards; I can relieve myself from the occupation in which I am engaged, and turn both eyes upwards, or direct them downwards, and, when I resume the writing posture, they are again directed downwards and inwards.

By no exertion can I direct both eyes outwards, or both downwards and outwards. In short the ability to turn both eyes outwards is altogether forbidden; even in the new-born infant, when the eyes by their irregular movements, evince the difficulty it experiences in its endeavours to fix them on an object, they never take either of these directions. And when we reflect that the direction of the eyes inwards is that which is continually being called upon in the exercise of our varied avocations, we cannot but be struck with the care which has been taken to accomplish this end.

Were both eyes capable of being directed outwards at the same moment, we would, it is true, be thus enabled to take an extensive field of vision on either side laterally and somewhat posteriorly, but then we would altogether lose sight of objects placed directly before us, and would be in a similar condition to those lower animals in which the eyes are so much behind, that they cannot see objects directly placed before them, and often suffer in consequence. The actions then of the two external recti muscles, and of the two superior oblique muscles, are remarkably contrasted with the actions of the other pairs. When either eye is drawn outwards by the action of the external rectus muscle, the other is directed inwards by the action of the inner rectus and the inferior oblique muscles; or when one eye is directed downwards and somewhat outwards by the action of the superior oblique muscle, the other is directed in the same proportion downwards and inwards in the diagonal of the inner and inferior recti muscles, so that in no movements of the eyes are objects placed before us lost sight of, for to the same extent that one eye is directed outwards the other is directed inwards.

These very opposite kinds of motions, enjoyed by two pairs of the ocular muscles and not by the others, must depend upon some peculiarity in the nerves which supply them, and we accordingly find that the muscles which act together in moving both eyes in the same direction, are supplied by the third pair of nerves, and that those which do not observe this consentaneous action, viz., the external recti and the superior oblique, are supplied with distinct nerves; which, as has already been observed, also gives these latter muscles a greater energy of action to compensate for the unfavourable position which they hold to the organ they are to move.

Other peculiarities, besides those I have noticed, distinguish the motor nerves of the eye. All of them are connected with the sympathetic nervous system by numerous filaments, particularly the abducens nerve, which receives two large ones, and which are in close contact with the internal carotid artery. These connections of the motor nerves of the eye with the sympathetic are so well known that it is unnecessary to dwell upon them here, further than to notice the fact, as it will serve to throw light upon those instances of temporary strabismus, which accompany affections of the *primæ viæ,* and of the respiratory organs.

The third nerve, or that which supplies four of the six muscles, is further distinguished from the others, in consequence of one of its branches, that which goes to the inferior oblique muscle, forming a remarkable communication with the small body, called the lenticular ganglion, from which the nerves for the supply of the iris proceed.

The contiguity which the motor nerves of the eye hold to several of the large blood-vessels of the brain is most remarkable, and will serve to account for many of those interesting cases of strabismus which follow determinations of blood to this organ.

The third, or common motor nerve of the ocular muscles, at its connection with the brain, is situated between two large and important arterial trunks, viz., the posterior cerebral and the superior cerebellar arteries, and as it passes forwards and outwards, it also holds a close relation to the cavernous sinus, being situated in a fibrous canal in its outer wall. After these relations to blood vessels it arrives at the foramen lacerum, before passing through which it divides into two branches; the smallest of which supplies the superior rectus, and the levator palpebræ muscles, and the largest, the inner rectus, the inferior rectus, and the inferior oblique muscles. The branch which supplies the inferior oblique sends a filament to the lenticular ganglion.

The fourth nerve, although the most remarkable of of all for its long and tortuous course, its delicacy, its forming communications with no other nerve, its being distributed to but one muscle of the eye, and its presenting the same peculiarities in all animals in which it is present, is not so intimately connected with the cerebral vessels as the others. From its origin it passes forwards, and before reaching the foramen lacerum, to arrive at its destination, it enters the outer wall of the cavernous sinus.

The sixth, or abducens nerve, from its origin at the upper margin of the corpus pyramidale, passes forwards and outwards, pierces the dura mater near the attachment of this membrane to the posterior clinoid process, and enters the fibrous wall of the cavernous sinus; it passes through the foramen lacerum, and runs between the origins of the external rectus muscle to the ocular aspect of which it is ultimately distributed by numerous filaments. This nerve, at its connection with the corpus pyramidale, is in relation with the vertebral artery of the corresponding side; afterwards it is situated external to the basilar artery, some of the branches of which cross it, and here the nerve is placed between the pons Varolii and the basilar process of the occipital bone. The next blood-vessels it holds intimate relation to, are the cavernous sinus and the internal carotid artery, being separated from the blood contained within the former merely by the lining venous membrane, and being closely situated at the external side of the latter. At its point of crossing the carotid artery two very remarkable filaments connect it with the superior cervical ganglion of the sympathetic nerve.

Besides the connection which we have seen to exist between the nerves which go to the muscles, the sympathetic nerve, and many of the great cerebral vessels, in consequence of which the actions of the muscles of the eye will more or less sympathise with derangement of the circulation within the head, or with derangement of those organs over the function of which the sympathetic nerve presides; these active organs of locomotion are moreover influenced by derangements of the passive organ, the eye, which they are destined to move. Thus, in opacities of the cornea, the eye will be often found to squint for the purpose of admitting the rays of light through its transparent portion, and in many instances I have seen patients who had lost the sight of one eye, from various causes and at various ages, become afterwards affected with permanent strabismus. It, however, not unfrequently happens that the weakness of vision is consecutive upon the strabismus, and evidently arises from the patient not making as much use of the eye which squints as the sound one. Where the blindness precedes the strabismus, little hope can be held out to the patient of improving the sight by the operation of dividing the muscle which produces the squint, although, by performing such, the appearance of the countenance will be remarkably improved; a fact which has induced young persons, especially females, to submit themselves to the operation; and in all instances it has been attended with the anticipated results. But in those cases where the weakness of sight is consecutive upon the strabismus, not only has the eye been relieved from its deformity by operation, but its sight has in many cases progressively and steadily amended.

ON THE INSERTION OF THE MUSCLES OF THE EYE.

The attention which has been given to the insertion of the muscles of the eye in anatomical writings has not been so great as that which the insertion of the other muscles of the human body have obtained, and this has, in all probability, arisen from their never having been made the subjects of surgical operation until within the last few months. The anatomy and functions of the muscles which surround the articulations have derived additional importance in their description, from being more or less displaced and injured when dislocations occur; the abdominal muscles were but faintly described by the older anatomical writers, but when the subject of hernia was investigated by Cooper, Scarpa, Lawrence, and others, every point about them was carefully investigated; and, after the Hunterian operation for aneurism, the anatomy of the sartorious muscle was minutely described, not from any great effects it is capable of producing as a muscle, but from the important relation it bears to the femoral artery as a guide to the surgeon in his operations upon that vessel.

For similar reasons the insertions of the muscles of the eye require now a careful investigation.

To accomplish this purpose, the most practical method of proceeding will be, to take the cornea as a point of reference, and to note the distances of the insertion of the tendons from its circumference; at the same time to remark any differences which exist in the extent of their insertions, and in the bulk of the muscles to which they belong.

Until I had practised the operation on the dead subject, of dividing the tendons of the several muscles of the eye, I received the general opinion that the recti were inserted at equal distances from the circumference of the cornea. I have since, by repeated dissections, shown that this is not the case, and also that the extent of their insertions differs very much from each other. On these dissections, and on the operations which I have performed in the living subject, the following dedescription is based.

All the muscles of the eye are inserted by flat, shining parallel tendinous fibres into the sclerotica, and this membrane, which forms the case of the eye, being globular, the shape of the insertion of each muscle necessarily forms a portion of the segment of a circle, the convexity towards the cornea; the consequence of which is, that the centre of the insertion of each tendon is nearer the cornea than its ends—a fact which would be likely to make a careless operator suppose that he had divided all the tendon of a muscle he was operating upon, when he had only divided its central fibres, leaving the extremities still attached.

The tendons of the superior and the inferior recti muscles are of equal breadth at their insertions; the breadth of the inferior oblique exceeds that of the superior by about a line, and the breadth of the internal rectus exceeds the breadth of the external by nearly one-third. These measurements are pretty constant in all subjects.

In the well proportioned eye of an adult, the centre of the tendon of the superior rectus, and that of the inferior rectus, are at an equal distance from the cornea—viz., four lines; the inner edges of each are about the same distance, whilst the outer edges are considerably more removed, being distant seven lines.

In consequence of this arrangement, both muscles will fairly antagonize each other in their alternate actions of raising the eye upwards and downwards; but, in consequence of the close proximity of the internal fibres of their tendons to the cornea, in comparison with the distance of their external fibres from this point, the former have much greater power in directing the eye inwards than the latter have in directing it outwards.

The centre of the tendon of the internal rectus muscle is distant from the cornea about three lines, its superior edge is distant four lines, and its inferior edge five lines.

Contrasted with the tendon of this muscle, that of the external rectus is distant at its centre from the cornea nearly five lines, and its superior and inferior edges are distant nearly six lines.

From this arrangement it is evident that the internal rectus muscle has more power in directing the eye inwards than its antagonist, the external rectus, has in directing it outwards; and from the superior fibres of the inner rectus advancing more towards the cornea, they have more power in giving the eye a direction upwards, than the inferior fibres have in giving it a direction downwards.*

The centre of the tendon of the superior oblique is distant eleven lines from the cornea, and that of the inferior oblique is distant fifteen lines from the same point, so that operation upon these muscles at their insertion is out of the question. The origin of the inferior oblique, at the depression of the lower margin of the base of the orbit, and the pully of the tendon of the superior oblique at the upper and inner angle of the base of this cavity, are the two situations to select for the section of these muscles.

In four eyes, the transverse axes of whose orbits were nineteen lines and a half, the situation of the pully and tendon of the superior oblique muscle was four lines and a half distant from the inner extremity, and was five lines deep, measuring from the upper edge of the orbit at this point; and in the same eyes the origin of the inferior oblique was four lines and a half distant from the inner extremity, and two lines deep, or behind the margin of the base.

I have in one instance divided the superior oblique muscle in the living subject, without producing any perceptible effect upon the motions of the eye-ball.

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* Besides the power which the internal rectus muscle possesses from its position, it also is larger than any of the other muscles, and this is evidently a provision to turn the direction of the eye inwards. In the sheep, where every provision is made for enabling this animal to direct its eyes outwards, such as the shallow orbit externally, the long transverse axis of the pupil, &c., the external rectus muscle is much larger than the internal.

The case was one of convergent strabismus, in which I had previously divided the inner rectus muscle, and also removed the subconjunctival and submuscular fasciæ from the inner surface of the eye-ball without producing that complete satisfactory result which attends this operation. By prolonging the incision of the conjunctiva upwards, I succeeded in passing the blunt hook around the tendon of the superior oblique muscle, and not merely divided, but excised a small portion of it. The peculiar rounded form of the portion of the tendon which was removed, made it evident to all present that it had been fairly cut through.

In the dead subject, the pully and tendon of the superior oblique muscle, and the origin of the inferior oblique muscle can be readily got at by making a semicircular incision of the integuments corresponding to their respective positions. In the former operation the inner division of the frontal nerve should be avoided. If it be attempted to get at either of these muscles by making an incision of the conjunctiva, the operation will be found to be more difficult.

OF THE TUNICA CONJUNCTIVA, AND OF THE SUB-CONJUNCTIVAL AND SUB-MUSCULAR FASCIÆ.

The four recti muscles, at their insertions into the sclerotica, are covered by the tunica conjunctiva, as it passes from the anterior part of the eye-ball, to the ocular aspects of the eye-lids.

This membrane, which is to the muscles of the eye and their tendons what the skin is to the muscles and tendons of other parts of the body, requires a brief notice, as it is first necessary to make an incision of it, to get at any of the muscles.

The tunica conjunctiva is a production or a continuation of the common tegumentary membrane of the body, but modified in its structure for the economy of the organs which it covers. It is in such close and intimate connection with the cornea, that even some have denied its existence in this situation. Comparative anatomy and disease, however, afford abundant proofs of its existence over the cornea; and, in the human subject, after the eye has been macerated for eight or ten days, I have easily demonstrated it over and over again. In this situation it is perfectly transparent, to admit the rays of light. From the circumference of the cornea it passes over the anterior aspect of the sclerotic coat of the eye, covering the tendinous insertions of the recti muscles, and also the anterior extremities of their fleshy bellies. In this situation it presents very contrary characters to that in which it lines the cornea; it is here semi-transparent, is very loosely connected to the subjacent parts by fine reticular tissue, and it possesses greater vascularity. From the eye-ball it is reflected upon the eye-lids, the inner surfaces of which it covers, and at their free margins it becomes identified with the fine skin which forms their outer coverings. Where this membrane passes from the inner edge of the circumference of the cornea, to the inner angle of the eye, it requires special notice, as it is not only more vascular in this situation, and is in intimate relation to the most important part of the lachrymal apparatus, but also covers the inner rectus muscle. As it approaches the inner angle of the eye it becomes thicker, and where it turns upon itself to form the plica semilunaris, it is very vascular. This fact should be always considered in making the section of the conjunctiva, for when the membrane is divided near to the plica semliunaris, the hemorrhage is always greater than when it is made nearer to the cornea. From the inner angle of the eye it enters the puncta lachrymalia, lines the lachrymal canals, sac and duct, and is at length continuous with the mucous membrane of the nares. —The great looseness of the conjunctiva to the sclerotica is evidently a provision for allowing the eye-ball to be moved freely in all directions; for were it otherwise, were it only the one-twentieth part as adherent to the sclerotica as it is to the cornea, no matter how energetically the muscular apparatus of the eye-globe might contract, it would be too powerfully opposed by a tense conjunctiva to enable it to effect the movements for which it exists. Too much stress, therefore, cannot be laid upon the propriety of injuring this membrane as little as possible in our operations, for the division of any of the ocular muscles, and of taking care not to remove any portion of it, lest extensive adhesions of it may take place to the sclerotica, or a contracted cicatrix follow, which would have the effect of mechanically preventing the perfect movements of the eye.

Behind the conjunctiva there exists a quantity of loose cellular tissue, upon carefully removing which a denser layer will be found immediately to cover the orbital aspects of the recti muscles, and to pass along their expanded tendons to the sclerotica, with the anterior surface of which it is in intimate contact, and is traceable along it to the circumference of the cornea, becoming thinner and more identified with the sclerotica as it gains this point.

This subconjunctival fascia, although exceedingly delicate, is sufficiently strong to offer considerable resistance to even a slightly blunted instrument; and as, in addition to its passing from all the recti muscles to the sclerotica, it also passes from the anterior surface of one muscle to another, forming a continuous circular membrane, it is of importance to be aware of its existence in performing an operation for the section of the tendons of the recti muscles. Unless the subconjunctival fascia be torn through or divided, the passage of an instrument beneath any of the tendons will be attended with difficulty.

In several eyes, which I have lately examined, this fascia presented different degrees of strength, such as we find to be the case in our examinations of the fascia Cooperi; and this anatomical fact most satisfactorily explains the ease with which, in some cases, an instrument can be passed beneath the tendon of the inner rectus muscle preparatory to its section, and the difficulty which accompanies this proceeding in others.

There exists another fascia in connection with all the muscles of the eye-ball which is deeper seated, of a more uniform density, is much stronger, and of equal importance with that I have just described. It is expanded beneath the muscles and their tendons, passing from one to the other, and covering the masses of fat which envelope the posterior part of the eye-ball. This submuscular fascia is easy of demonstration. The eye and its appendages, with half an inch of the optic nerve, should be removed from the orbit and placed upon a plate, the cornea being downwards. The masses of fat, together with the loose cellular tissue and blood-vessels, should be carefully dissected away, and the muscles be turned forwards towards their insertions, not dissected as if with a view of exposing their appearance, but merely expanded upon the surface of the plate.

If the neurilema of the optic nerve be now examined, it will be found covered with a fine fascia, which can be easily raised with a forceps, and with little difficulty can be traced off the neurilema to the sclerotic coat at the point where the nerve enters. It will be now found to cover the posterior aspect of the sclerotica, and to advance as far as the insertions of all the muscles of the eye; at this point it turns upon itself, lines the ocular surfaces of the muscles, and passes backwards along them to where they surround the optic nerve.

The submuscular fascia, like the subconjunctival, passes also from one muscle to another, and forms a strong continuous double circular membrane behind them, the masses of fat, enveloped with their own proper cells, being placed between its layers.

It also affords considerable resistance to the passage of an instrument beneath the tendons of the muscles, and in operating upon them requires to be fairly divided.

In the eyes of young subjects, I have never found either the subconjunctival or the submuscular fascia as strongly developed as in the adult, and in this they resemble the tunica sclerotica, and the muscles themselves.

The degree of development of both these fasciæ in some cases I operated upon for the division of the internal rectus muscle, was very great, and was quite sufficient, after the muscle was fairly divided, to give the eye an inclination inwards; when I divided this tense structure, the eyes became perfectly straight. Contractions of other fascia of the human body, as the plantar and palmar, are so frequent as constantly to call for operation, and the development and contracted state of the subjunctival and submuscular fascia resemble these, and require careful examination before the surgeon pronounces that he has succeeded in curing a squint, after he has divided the tendon of the muscle.

CAUSES OF SQUINT.

Squint essentially depends upon the perverted action of one or more of the muscles, which are provided for the movements of the visual organs; it therefore follows that this affection may not only assume various degrees of intensity, but also various directions, according to the muscle or muscles which are at fault.

From the anatomical and physiological remarks which have preceded this treatise, it is apparent that the muscles of the human eyes may become perverted in their action from various causes.

As muscles they are liable, like similar organs in other parts of the body, to lesions of their nutrition, by which they become wasted or atrophied; may become more than naturally developed, or hypertrophied; or may become altogether changed in their structure.

The intimate connection which exists between the motor nerves of the eyes and the sympathetic nervous system, will account for those numerous cases of temporary strabismus, which depend upon affections of the digestive organs; and the remarkable connections of these nerves with the brain, and their close relation to many of the cerebral blood-vessels, will also as satisfactorily explain those inveterate cases of permanent squint which so often follow diseases of the brain, and determinations of blood to that organ.

Not only are we thus furnished with fruitful causes of strabismus in most of those affections incidental to early life, and in many which occur in riper years, but in consequence of the muscles of the eyes being subservient to the optical instruments which they are destined to move, diseases of the latter, and even of their appendages, are also frequent causes of squint.

External violence to distant parts and to the parts in the immediate vicinity of the orbits must be also enumerated as causes of strabismus, and also habit or imitation.

SQUINT FROM LESIONS OF NUTRITION OF THE MUSCLES OF THE EYE.

I have had many opportunities of witnessing the great development of the inner rectus muscle in convergent strabismus, and many of my professional friends, who have been present at the operations I have performed, have satisfied themselves that the muscle was in this state.

In such cases the muscle was not merely increased in bulk, but was also much more vascular, and of a deeper colour than natural, conditions which remarkably contrast with the appearance the muscles of the eye present in their healthy state.

When the muscle is thus unnaturally developed, the operator should be prepared for a good deal of hæmorrhage upon its section being made, say from ten to twenty drops; but what is of greater practical importance to remember is, that it is in those cases where the muscle is in this state, it forms strong adhesions to the sclerotic coat of the eye, and at the end of ten or twelve days gives the organ an inclination inwards, varying more or less in degree, but never to the extent it had before the operation.

In my early operations, I was necessarily unprepared for this occurrence, and had in a few cases to operate a second time, and I always found that the muscle had united to the sclerotic coat a line and a half or two lines behind its original insertion, and drew the eye slightly inwards. The mark of the original attachment of the muscle was apparent to all present, as well as the new attachment of the muscle.

Had we the same power of applying mechanical contrivances to control the motions of the eye after the division of its muscles, which we possess in those cases of deformities of the neck and extremities which we cure by the division of their muscles, there would be little fear of any degree of strabismus returning after operation; but in the case of the eye, this power being denied us, the surest way to guard against such an occurrence is to cut away a portion of the muscle itself, which can be easily done—a practice which I have since adopted, when the condition of the muscle appeared to me to call for it.

In a conversation I had with Sir Benjamin Brodie, soon after I had operated on four or five cases of strabismus, this reflecting surgeon anticipated the re-adherence of the muscle to the sclerotica after its division, for the reason I have just mentioned.

The following case, condensed from the Lancet, is instructive in many ways.

CASE 1.

" May 2, 1840.—A. B., *etat.* 25, has had strabismus " since he was four years old, which is attributed to one " or two causes — viz., convulsions occurring after " measles; or to a small tumour, which was situated at " the inner canthus, to which the affected eye was con- " stantly attracted. The eyes are of a dark brown " colour, and the affected one appears smaller than its " fellow. The right eye is directed deeply inwards, so " much so, that when both eyes are open, not more " than two-thirds of the cornea of the affected one can " be seen; it also turns very much upwards, more so " than in any of the other cases I have operated " upon.

" In the presence of Dr. Walsh, Mr. Peplow, Mr. " Sharpe, and Mr. Parke, I divided the internal rectus " muscle. *The hæmorrhage was very considerable,* " *amounting to twelve or thirteen drops.* The eye " almost immediately became straight; it was at first

" directed too much upwards after the operation, but " in a few minutes it righted itself, *and both eyes acted " in perfect unison.*

" The *muscle* in this case was *unusually developed;* it " was *fully twice as large* as I expected, or as anatomy " reveals it to be; it was also *powerfully contracted,* " giving it a rounded appearance, and was *very red and " vascular,* which accounted for the *hæmorrhage.*

" May 3.— The eye is *perfectly straight,* and follows " the movements of its fellow as it should do. He " says he can see objects more distinctly than before. " I placed my fingers before his eyes at various dis- " tances, and watched their movements; he suffers no " confusion of vision, although it is the first time for " these twenty-one years he has seen objects with both " eyes at the same moment.

" On the 9th he returned to his trade.

" 16th.—The wound of the conjunctiva is perfectly " healed; the eye, however, *is inclining inwards,* and " this is most remarkable, when both eyes are directed " forwards.

" 26th.—I this day, in company with Dr. Hennis " Green, called upon my patient for the purpose of ex- " amining the eye, to ascertain if anything further could " be effected by operation, but he was from home; " and the following morning I had a visit from Mr. " Peplow, his ordinary medical attendant, who told me " that our patient was persuaded to undergo a second " operation at the hands of another surgeon, in conse- " quence of that surgeon giving the patient to under- " stand that the muscle in the first instance had not " been divided."

The opposite state to the condition of muscle I have just noticed, as a cause of strabismus, is rather to be inferred than demonstrated; for, if any of the muscles of the eye be in a state of atrophy, their antagonists, without any unnatural degree of development, will necessarily act to an advantage incompatible with the healthy movements of the eye, and produce strabismus, to cure which we operate upon the muscle which is not virtually at fault, but upon that whose increased action is owing to the weakness of its antagonist, and not to any power residing in itself from an increased development of its fibres.

In our operations, therefore, for the cure of convergent strabismus, when the internal rectus muscle presents no deviations from a state of health, although we have no means of actually ascertaining the condition of the external rectus muscle, it is a reasonable inference to draw that it is more or less wasted. It cannot be paralyzed, otherwise it would be incapable of drawing the eye outwards, which in all the cases of convergent strabismus I have operated upon, it had more or less the power of doing.

In one case of divergent strabismus, when the external rectus muscle was exposed, it was remarkably wasted, and, notwithstanding, it had the power of producing divergent squint. When the muscle in this case was divided, the eye was not drawn forcibly inwards, as it otherwise would have been, had the integrity of the inner rectus muscle been perfect. The eye was capable of being drawn as far as the inner canthus, but the patient could not turn it deeper, as can be effected to a very considerable degree when the inner rectus muscle is healthy. The inner rectus muscle must have suffered some change, so as to completely interfere with its function, and in consequence of which the outer rectus muscle, notwithstanding that it was so much atrophied, had the power of producing divergent strabismus.

It is not uncommon to find the internal rectus muscle to present marked deviations from its natural structure. This is not surprising, when we consider the changes of structure which take place in muscles elsewhere; but whether these deviations are subsequent or antecedent to the strabismus, is not easy to determine.

CASE II.

A boy, aged ten, was born with his eyes perfectly straight. When two years of age he suffered from convulsions, and, after a severer one than usual, the strabismus took place.

Before the operation his left eye was turned deeply inwards, with a slight degree of obliquity upwards, and he could only evert his eye to the extent of four lines, and that with much difficulty. The appearance which the muscle presented was described in the report of this case in the following words. The tendon of the muscle was unusually thick and strong, far different from the appearance which it presented in the other cases, it *grated* beneath the blades of the scissors upon dividing it, which being accomplished, the eye became instantaneously straight.

Mr. Middlemore observed the external rectus muscle to be hypertrophied in a case of divergent strabismus. "The external rectus of the eye affected with strabismus was much larger than it "ought to have been—much larger relatively to the "size of the other muscles of the same eye, and, com-"paratively, with those of the opposite organ. Other "circumstances may induce a disproportion in the form "and power of the muscles of the eye-ball, and will "lead to the establishment of a variety and extent of "strabismus, corresponding to such changes." *

The varieties of strabismus which depend upon alterations in the structure of the muscles of the eye must necessarily be more or less permanent; not so, however, with those cases of squint which depend upon other causes.

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* A treatise on the diseases of the eye, &c., 1835.

One of the commonest forms of strabismus met with is that which is sometimes called, in popular language, " a cast," and from its being dependant upon affections which are traceable to distant organs, it does not call for operation ; it yields to remedies of a milder nature, when administered with decision and perseverance, and it usually disappears if the original cause which produces it is timely removed.

It not unfrequently happens that in children this temporary strabismus is allowed to continue, without any remedial measures being resorted to, or the cause upon which the abnormal actions of the ocular muscles depend is overlooked, and the treatment is ineffectually directed to the eyes themselves for a long period. In confirmation of this, I need only refer to those cases of strabismus occurring in early life, in which goggles and other mechanical contrivances have been worn by children, sometimes even for years, with no happy results ;—many of which have come under my notice.

During this loss of time the muscle, or muscles, from being accustomed to act in a vicious manner, at length persist in doing so habitually, and with an increased degree of intensity, until at length a permanent squint is the consequence. In such cases, no matter how energetically the attention of the surgeon be directed to the original cause which produced the strabismus, his efforts will be unattended with benefit ; and, to remedy the permanent deformity of the eye or eyes, an operation becomes indispensable.

SQUINT FROM DISEASES OF THE DIGESTIVE ORGANS.

There are no more fruitful causes of the kind of strabismus under present consideration than those morbid affections of the digestive canal, which are met with in early life—whether these be referable to the canal itself, or to sources of irritation contained within it, such as worms, indigested food, and the like.

CASE III.

A few weeks since a young lad, aged ten years, presented himself at the Metropolitan Free Hospital, complaining of headache, loaded tongue, accelerated pulse, and temporary strabismus. His right eye was occasionally directed upwards and inwards. His mother remarked, on my directing her attention to his eyes, that when the boy's bowels were constipated, which was constantly the case, he always squinted. Under the use of calomel, rhubarb, and ginger, the ordinary aperient powder of the hospital, his bowels were freely acted upon, and the strabismus, with his other symptoms, disappeared.

Amongst forty-five children at a public school in this metropolis, six of them are affected with temporary strabismus. I have occasionally seen them within the last three months, and the irregular actions of the muscles of their eyes are clearly traceable to derangements of the primæ viæ. They are all day-scholars, and have never shown symptoms of cerebral disease. In some of these children, as many as two or three days have been allowed to elapse without their bowels being moved, and in others the bowels have been affected several times in the four-and-twenty hours.

When temporary strabismus in children is dependent upon derangements of the primæ viæ, it is at one time much severer than at another; it disappears for a longer or a short period, but never leaves the patient entirely free for the day, as long as the cause upon which it depends is allowed to operate. Teething, and the presence of worms in the intestinal canal, constantly produce strabismus. Mr. Wardrop observes that, "in "some instances, the state of the eye forms an accurate "measurement of the degree of derangement in the "alimentary canal."*

In adults affected with permanent squint, it is a common occurrence to find its intensity increased whenever the functions of the digestive organs are deranged, and, except in the severest form of permanent strabismus, this is so constantly the case, that the patients seldom fail to remark it.

Many other affections of the eye, besides strabismus, are clearly traceable to derangement of the primæ viæ, such as amaurosis, muscæ volitantes, hœmeralopia, &c.

The following is interesting, in illustration of these remarks :—

CASE IV.

William Ball, aged ten years, of a full habit, an inmate of a charity school, was in his turn permitted to spend the Sunday with his parents, and on several of these occasions, when he returned in the evening, he was seized with hœmeralopia. When thus attacked he could not even distinguish the candle in his bed-room, and was obliged to be conducted to bed by his schoolmates. On the occasion of his first attack, the cause of the hœmeralopia was overlooked, and it returned about the same hour every evening for three or four times, decreasing in duration until it finally ceased. The after attacks were summarily dealt with by the administration of purgative medicines, and the blindness did not return as on the first occasion. This boy has also had repeated attacks of temporary strabismus, when his bowels were confined, which yielded to smart purgation.

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* The Morbid Anatomy of the Human Eye. By James Wardrop, 1834. Second edition.

SQUINT FROM DISEASES OF THE BRAIN.

The affections of the brain which give rise to strabismus, both in its temporary and permanent forms, are very numerous. In hydrocephalus, strabismus is a common occurrence.

CASE V.

A boy, aged nine years, who had been frequently, for the last three years, under the care of his medical attendant for symptoms threatening hydrocephalus, had always on such occasions temporary strabismus. His head was unusually large, and the veins of his forehead were large and distended. Either eye would be alternately directed upwards and inwards, and would remain thus distorted for two or three hours at a time.

Sudden determinations of blood to the brain are fruitful causes of strabismus. My notes of the cases in which I have operated show that, in numerous instances strabismus followed a paroxysm of hooping-cough, a convulsion and attack of croup, &c., and in the adult I have traced two well marked cases of convergent strabismus to excess in venereal indulgences.

A most interesting case of strabismus, produced by this cause, was lately communicated to be by an eminent physician. The patient was young, and was suddenly attacked with strabismus, which, after a few weeks, was completely cured by the detraction of blood and other antiphlogistic measures, accompanied with the utmost caution in his manner of living. Some months afterwards he indulged as freely as before, and died from cerebral apoplexy.

In all those cases the squint took place suddenly, and resisted various kinds of treatment. The relation of the nerves which supply the ocular muscles, particularly of the third and sixth to the blood-vessels of the brain, will serve to throw some light in accounting for those determined cases of squint which arise from an undue quantity of blood being suddenly sent to that organ; and, in the two cases I have mentioned, if the relation of these nerves to the arteries which supply the cerebellum and adjacent cerebral masses, be considered, a still more satisfactory explanation of strabismus following excess in venereal indulgences offers itself.*

Temporary forms of strabismus are also caused by mental emotions, and I have in many cases seen that permanent squint was always aggravated by anxiety and irritation.

SQUINT FROM EXANTHEMATOUS DISEASES.

Strabismus constantly follows exanthematous diseases, especially measles, from the conjunctiva and retina being more or less engaged in these affections, as is evidenced by the suffused and watery eye, and the morbid sensibility to light.

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* " M. Rolando constantly observed that the diminution of the movements was in a direct ratio with the lesion of the cerebellum; that " stupor was never produced, nor the sensibility of any part of the " body impaired; but that the power of the muscular movements was " lost. The animals keep their eyes open, and regard surrounding " objects, but in vain endeavour to execute any of the movements " necessary for locomotion."

The experiments of M. Flourens show that, when the cerebellum was extirpated in animals, " volition, sensation, and memory were not lost, " but merely the faculty of combining the actions of the muscles in " groups."

" Hertwig also observed in a dog, in which the pon varolii was " wounded on the right side, that revolutions of the body towards the " same side were performed, and one eye was turned upwards, while the " other was turned downwards."—*Müller's Physiology.—By William Baly, M.D.*

CASE VI.

June 13, 1840.—Mr. H—— M——, *ætat* 36, had small-pox when he was five years old, which terminated without leaving any blemish of the skin, but which was followed by squint. His right eye is turned deeply inwards.

CASE VII.

Mary Anne Daly, *ætat* six, was born with her eyes perfectly straight. After the measles she suffered much from strumous opthalmia; on being cured of which, it was found that her right eye was permanently turned into the inner canthus, with also a slight degree of obliquity upwards. The strabismus has existed for three years.

CASE VIII.

Henry Bradshaw, *ætat* nine, when six years old, had measles; his eyes were much affected during the disease, and on recovery the left eye was observed to be turned inwards.

SQUINT FROM INJURIES OF THE HEAD AND ORBIT.

Injuries of the head and orbit from blows, falls, and other kinds of external violence, frequently cause permanent squint.

CASE IX.

Mr. H., *ætat* 28, received a blow on the forehead between the orbits, when he was five years old, which deprived him of his senses for two hours; when he recovered, the left eye was turned inwards, and was in perfect darkness for many months. From time to time the vision of the injured eye began gradually to improve, but the strabismus remained stationary.

CASE X.

John Pennington, *ætat* 16, got a fall upon the vertex of his head when a child, and was under medical treatment on account of its effects for some weeks. The strabismus took place immediately after the accident. He has been always able to see equally well with either eye.

CASE XI.

Mr. K. pursued a thief from his shop who had ran off with some of his goods, and, when in the act of seizing him, the fellow turned round and struck Mr. K. with a short stick on the outer angle of the left orbit. The blow stunned him for a moment or two, and, on Mr. K.'s returning home, he was observed to squint. This occurred some years since, and the strabismus remains.*

Other injuries, besides blows, have been found to be followed by strabismus. Mr. Mackenzie mentions a case in which squint was caused by squirting the juice of fresh orange peel against the surface of the eye, which at the same time produced considerable smarting.† And Mr. Middlemore has remarked that the application of a blister behind the ear was, on several occasions, followed by temporary strabismus, but that it never lasted long; "it has not, in any single instance, been "permanent when so produced."‡

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* Cheseldon, Abernethy, and others mention cases of strabismus which have occurred from similar causes.

† A Practical Treatise on the Diseases of the Eye.

‡ Middlemore on the Eye, 1835.

SQUINT FROM IMITATION, OR HABIT.

That imitation or habit often cause both temporary and permanent strabismus, there can be little doubt. Making all due allowance for the tales of parents and nurses, I have traced many cases of strabismus to this cause.

When it is considered that the recti are voluntary muscles, and that most individuals have the power of distorting their eyes at will, it is not to be wondered at, particularly in early years, that, by constantly moving them in a wrong direction, they may at length become permanently distorted.

CASE XII.

Master S., at the age of fourteen, placed the clavicle of a fowl on his nose, for the purpose of passing a thread through a small hole made at its apex. After several ineffectual attempts he at length succeeded, but was rewarded for his experiment by convergent strabismus of both eyes, which lasted two days. During this time he experienced an uneasy sensation of fulness in the eyes, which gradually subsided, together with the strabismus. This patient has now his eyes perfectly straight. During the existence of the strabismus he never saw double, but experienced a slight dimness of vision ; and this is the more singular, for if we voluntarily direct our eyes so as to produce squint, double vision is the consequence.

CASE XIII.

James Healy, ætat 20, when five years old, got convergent strabismus of the left eye, from imitating his schoolmaster who squinted. His father and mother had often occasion to punish him for so doing. I inquired particularly into the history of the strabismus for a more satisfactory cause, without being able to detect one.

On dividing the internal rectus muscle in this case, it presented no deviations from its natural structure and size.

CASE XIV.

James Rusholm, ætat 23, has had strabismus since he was five years old. His parents can assign no cause for it, beyond his having been constantly in company with a playmate who had a similar affection. In this case also the inner rectus muscle presented no deviations from its natural state.

CASE XV.

Thomas Christian Thompson, *ætat* 26, has convergent strabismus of both eyes ; the squint is more intense in the left. This patient had perfectly straight eyes until he was 15 years old, at which time he contracted the strabismus, from imitating his school-master who squinted. The age of the patient at the time the strabismus occurred, cannot leave a doubt that it was caused by imitation.

SQUINT FROM CORNEAL OPACITIES.

The cases of strabismus which depend upon affections of the eye itself, are very numerous, and it requires a careful investigation into the state of the organ before an operation be performed to remove the squint. I have met with several cases of strabismus, which followed various degrees of corneal opacity. In some of these the eye was evidently turned for the purpose of admitting the rays of light through the transparent part of the cornea. In others there were adhesions of the iris to the cornea, and slight opacity of the latter, accompanied with squint. It is evident that cases of strabismus, occurring from such causes, should not be interfered with by the division of the muscle, which produces the deformity ; yet such is the desire for operating, which takes possession of some, that the internal rectus muscle in one of these cases was divided, notwithstanding that I had refused to operate upon the patient, and that my reasons for so doing must have been apparent to the meanest capacity.

SQUINT FROM AMAUROSIS.

Amaurotic affections are sometimes followed by strabismus, and under certain circumstances an operation to cure the deformity becomes admissible.

CASE XVI.

A young lady, of considerable personal attractions, consulted me some weeks since, under the following circumstances:—She was 23 years of age, and had lost the sight of her right eye when a girl. She could not distinguish objects with it, but could discern light from darkness. The eye was to all appearance as healthy as the sound one, but was inverted. Her irides were of a light blue colour, and she could freely withdraw the turned-in eye from its unnatural position when the other was closed. Her anxiety to have the strabismus removed arose from a feeling of awkwardness she experienced amongst strangers, in consequence of the deformity. I divided the internal rectus muscle, when the eye immediately became straight, and the difference in her appearance was most remarkable.

SQUINT WITH DISPARITY OF THE EYES, AND WITH DISPARITY IN VISION.

I have met with some cases of strabismus, accompanied with marked disparity in the size of the eyes, and many with disparity in the vision of both organs.

In the former cases the disparity was remarked by the parents before the strabismus occurred, but in the latter it generally followed the strabismus; and in some of these cases, after the eye was restored by operation to its natural position, it was most gratifying to observe the steady improvement which took place in its vision. This fact would incline me to suppose that where strabismus is accompanied with disparity in vision, the turned eye becomes weak from want of exercise, particularly when it is remembered that disparity of vision is constantly met with, unaccompanied by squint.

I do not, however, mean to assert, that one eye being more sensible to light than another, may not give rise to strabismus, and that while the patient habitually uses the stronger organ in viewing objects, he either neglects the impression made upon the weaker one, or turns it altogether away; the consequence of which would be that the weaker eye would acquire movements independent of its fellow, and a permanent squint ultimately follow.

It sometimes happens that temporary strabismus arises from the too great sensibility to light of both retinæ, without there being any disparity of vision.

CASE XVII.

John Thomas, aged eight years, had a fit when he was two years old, and has been the subject of temporary strabismus for the last twelve months. His left eye turns upwards and inwards about noon, when the light is greatest; when, within doors, his eyes are generally straight. His mother says, that yesterday (Aug. 2) he was all day within doors, and did not squint; his eye is now turned, and he is in a bright light.

He can distinguish letters placed at a great distance equally well with either eye. Both pupils are of equal size, and the irides act equally. He has no head-ache; his bowels are occasionally relaxed; and, beyond the intolerance of light and the temporary strabismus, his eyes and their appendages are free from disease.

It is difficult to account why the strabismus in this case is confined to one eye, unless we admit the preponderance of the right eye, in common with the right side of the body over the left; a question concerning which there exists some differences of opinion. At all events, the record of the cases I have kept of permanent strabismus shows that the left eye is affected in the proportion of three to two.

SQUINT FROM POSITION OF HEAD.

There are some well authenticated cases of squint which were produced by the head being kept for a long time in an unusual position.

"A young lady was confined for several weeks to bed, with a disease of the hip-joint, in a room lighted by a window on one side. She was in the habit of turning her eyes constantly to the light, and thus contracted a squint; which was easily cured by simply changing her position in the room."

"Another young person, from remaining ten days on one side, acquired a squint, which lasted seven years;

it was afterwards removed by looking a great deal in the opposite direction."*

In children, however, I am afraid too much stress has been laid on long retention of the head in one position, on injudiciously placing them in their cradles, or on two objects being placed before them in such a manner that they view at the same time one on the right side, and the other on the left side.

In such cases the deformity of the eye must be outwards, and divergent strabismus is so rare an occurrence that out of some hundreds of cases which I have seen within the last six months, I have met but one case of this kind. Besides, it has been shown in the physiological part of this treatise, that the direction of both eyes outwards at the same time has been wisely guarded against.

SQUINT FROM DEFORMITIES.

Tumours in the eye-lids and their vicinity, extensive cicatrices, nævi, and other deformities of this kind, frequently induce temporary forms of strabismus, and in some cases permanent squint.

CASE XVIII.

A gentleman applied to me with an encysted tumour, which was so situated in the lower lid that he constantly directed the eye of that side towards it, at the same time that he exercised the other for the purposes of vision. I removed the tumour five weeks ago, but as yet there is no amendment in the strabismus.

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* Wardrop on the Eye, cit.

CASE XIX.

At a public entertainment, given in support of the funds of a charitable institution, one of the musical performers engaged for the occasion, when employed in singing, invariably directed one of his eyes upwards and outwards towards a cicatrix in the eye-lid, which remained after the excision of a tumour, which was removed many years before. When not engaged in his professional duties the eye never took this direction.

CONGENITAL SQUINT.

Although it is common to hear congenital strabismus talked of, yet I never met with but one case of the kind out of all that have presented themselves; the affection seldom makes its appearance until two or three years after birth, and I have known one case of a lady who squinted, to have given birth to two children, a boy and a girl, with perfectly straight eyes, both of whom began to squint, one at the age of three, and the other at the age of five. I operated upon the boy, who was nine years old at the time.

Since my attention has been directed to this subject, I have brought to my recollection several fathers of families who squinted from their youth, but none of whose children have had strabismus. The avocations of the father of a family necessarily prevents that constant intercourse with his children until they arrive at a time of life when all danger of producing strabismus by imitation may be said to have ceased.

In the case of the lady alluded to, she moved in a sphere of life which called for that constant attention to the wants of her children, which is administered to them by proxy in higher or wealthier society; the strabismus was constantly presented to them, and as, in both the boy and girl, none of the causes which I have already noticed preceded the affection, I have little doubt it was the result of imitation.

If hereditary predisposition to strabismus exists at all it must be a very rare occurrence, for the cases of squinting children, whose parents have had straight eyes, and the cases of squinting parents who have had children with straight eyes, are beyond number.

OF THE DIFFERENT FORMS OF STRABISMUS.

Notwithstanding that the eye or eyes may be viciously directed in any of the ways which they naturally move in, yet, beyond all comparison, convergent strabismus is that which is most frequently met with.

As I have already stated, that, out of some hundreds of cases of squint which I have seen within the last six months, but one was of the divergent kind, and those others in which the eye was not directed inwards were very few, and arose from the existence of cicatrices, tumors, nœvi, or other deformities in the vicinity of the orbits.

I do not mean it to be inferred from this statement that divergent strabismus may not be more frequent than in the above proportion—indeed, I can bring to mind at this moment three cases of divergent strabismus amongst my immediate friends; but, out of all the cases which presented themselves for operation, there was but one of the divergent kind.

CONVERGENT STRABISMUS.

Convergent strabismus may affect one or both eyes; when both eyes are affected, they never are turned in at the same time, so as to hide portions of both corneæ, although when one cornea is more than half hid, the other has generally a slight inclination inwards. Sometimes, however, one eye will remain in the centre of the orbit when the other is turned upwards and inwards.

A patient with double strabismus may lead an inattentive observer to think that one eye only was affected, did he merely depend upon his taking a cursory glance at the countenance. I have met patients with double strabismus, who would for several hours use but one eye in viewing objects, whilst the other remained buried in the inner canthus, but the moment the hand was placed over the apparently straight eye, the organs, as it were, changed places, and that which was before straight became inverted, and the other occupied a natural position in its orbit.

It is of importance, then, in all cases of convergent strabismus, to examine carefully the condition of both eyes before operating, lest, when one eye was restored to a natural position, the other would become inverted; and, although this is actually what occurs in such cases when the inner rectus muscle of one eye in double convergent strabismus is divided, yet, if the surgeon was not aware of the fact, and did not prepare both the patients and their friends for the consequence, on the eye opposite to that operated upon, he would get the credit of substituting one squint for another.

To ascertain the state of both eyes and the actual amount of deformity which exists, I have found the following method most satisfactory. If it is the right eye which is inverted, and the patient is employing the left for vision, I place my hand obliquely over the left eye in such a manner as to hide all objects in front of it, but keep the hand sufficiently raised at the temporal margin of the orbit to enable me to watch its movements. I then desire the patient to exercise the eye which is uncovered; and if at the time that he brings it to the centre of the orbit, the covered one retreats into the inner canthus, the case is one of double convergent strabismus, and both eyes will require to be operated upon; but if the contrary occurs, if both eyes are at this period straight, or even if the covered eye has but a slight inclination inwards, the case is one of single convergent strabismus, and the inner rectus muscle of one eye only will require to be divided. I have in several instances seen the eye which was not operated upon have a slight inclination inwards for many days after the operation; but, when the healing process was completed, and both eyes were freely exercised by the patient, this inclination inwards gradually became less and less.

CASE XX.

DOUBLE CONVERGENT STRABISMUS.

Mr. Mills, *etat.* 21, has had strabismus since he was three years old. When he looks directly forward with either eye, the other turns inwards and slightly upwards, so as to conceal about one-third of the cornea; but the right eye more. The pupil of the turned-in eye dilates to double the extent of the other. Until he was three years old, the movements of his eye were perfect. At that period one of the eyes became slightly inverted, and the deformity was endeavoured to be removed, by keeping the sound eye covered with a bandage, but without any happy result, and the eyes soon acquired their present movements. By some of Mr. Mills's relatives the strabismus was attributed to cold, and by others to a fall.

June 12th, 1840.—In the presence of Mr. Pilcher, Mr. Chaldecott, and Drs. Wild, Pettigrew, and Walsh, I divided the internal rectus muscle of the right eye, which immediately rendered it straight, and visibly more prominent than its fellow. The left eye, as was anticipated, turned in, which the patient was told to expect before the operation was performed. From there being not the slightest hæmorrhage, and the patient being completely under control, from his temporary debility, the operation occupied less than two minutes.

June 16th. — Proceeding favourably. No pain or uneasiness since the operation. There is considerable vascularity of the conjunctival vessels in the vicinity of the incision, and a vertical layer of lymph, about a line thick, between the divided conjunctiva, the edges of which membrane are slightly swollen. The left eye is turned in more permanently than before; he can, by an effort, direct both eyes to the same object, but can retain them so only for a few minutes.

June 21st.—At the first operation it was determined that the left eye should be operated upon after a few days; and this day, with the kind assistance of Mr. Pilcher and Mr. Chaldecott, I divided its inner rectus muscle. The eye immediately became straight, and equally prominent with its fellow, and both eyes moved naturally.

CASE XXI.

June 10th, 1840.—Mary Anne Davis, *etat.* 17, has been affected with double convergent strabismus since she was two years old, which was caused by a fall off a high bedstead, upon her head. Her irides are of a dark brown colour. When she looks at an object with either eye, the other turns upwards and inwards, so as fully to conceal two-thirds of the cornea. The strabismus is even more intense in the right eye. Her education has been entirely neglected in consequence of the state of her vision. She cannot work at her needle for longer than ten minutes at a time, in consequence of the objects appearing dull and confused. She is an intelligent girl, and gives an account of the distressing state of her eyes.

In the presence of Mr. Pettigrew, Dr. Hennis Green, and Dr. Pettigrew, I divided the internal rectus muscle of the right eye, when it immediately occupied the centre of the orbital axis, and became more prominent than the other. The left eye remained turned upwards and inwards. I operated on the second eye three weeks after, when both organs became perfectly straight, and equally prominent.

August 13th.— Her eyes are perfectly straight, and follow each other's movements harmoniously. Her vision is remarkably benefited. Before the operation she suffered the greatest inconvenience in pursuing her ordinary avocations ; even in walking objects appeared confused to her, and she could not judge of their distance. She can now work at her needle without any inconvenience.

SINGLE CONVERGENT STRABISMUS.

Convergent strabismus of one eye is that which is most frequently met with ; it varies in degree, in some being very slight, and in others the eye is so much turned in as to interfere altogether with its functions, unless the unaffected eye be closed.

In convergent strabismus of one eye, after the inner rectus muscle is divided, the organ, in some cases, not only becomes straight, but also prominent, so as strikingly to contrast with its fellow.

This has occurred in patients in whom the eyes were naturally full and prominent, as well as in those in whom the eyes were small and sunken; but in the former cases, after a fortnight or three weeks interval, both eyes appeared equally well set, whereas in the latter one eye remained prominent, and the other sunken, although that both eyes were perfectly straight.

In these latter cases, if the inner rectus muscle of the sunken eye be divided, the operation will be attended with the best effects; both eyes will be equally prominent, and contrary to what might be expected, they will also be equally straight, no trace of strabismus remaining.

CASE XXII.

Mr. Henry Mills, *ętat.* 22, has had convergent strabismus of his right eye since he was four years old. His irides are of a dark brown colour, and the eyes are small and sunken. When the hand is placed over the left eye, he is able to bring the right one to the centre of the orbit. The left eye is unaffected.

On July the 28th, 1840, I divided the right inner rectus muscle, when the eye immediately became straight, but more prominent than its fellow.

August 7th.—The effect of the operation was this day as follows:—

Scarcely a mark of the incision was present. Both eyes were straight, but at times the left eye appeared to have a slight inclination inwards. I mention this, although it appeared to some of those present that both eyes were perfectly straight. The right eye is much more prominent than its fellow, and forms a striking contrast to it in this respect. In the presence of Mr. Kraus, Mr. Cameron, and Mr. Earle, I divided the inner rectus muscle of the sunken eye, which at once made it equally prominent with its fellow, without producing the least deformity of it.

The difference in the appearance of the patient was most remarkable.

Aug. 26.—Saw Mr. Mills this day; the incisions of the conjuntiva are scarcely perceptible; both eyes are equally prominent, and follow each other's movements with regularity.

The division in this case of the inner rectus muscle of the eye *which did not squint* has been attended with the most satisfactory results, and practically illustrates in the living subject some of the physiological views which have been advanced in the preceding part of this essay, regarding the actions of the oblique muscles.

DIVERGENT STRABISMUS.

In divergent strabismus the affected eye takes the opposite direction to that form which has just been considered.

The only case in which I operated for this deformity was the following:—

August 1st, 1840.—Jane Johnson, *etat.* 30, has had divergent strabismus of the left eyesince she was eight years of age. Her eyes are prominent, and the irides are of a grey colour. When both her eyes are open, and the right one is directed forwards, the left occupies the external canthus; when she turns the right eye as much outwards as possible, the left then occupies a position a little internal to the axis of the orbit; when the right eye is covered, so as to exclude the light, she can then turn the cornea of the left eye as far as the plica semilunaris, but she is incapable of turning it deeper, so as to hide any portion of the cornea—a motion which can always be effected in the natural condition of these organs.

In the presence of Dr. Léon Husson, Dr. Dolce, Mr. Cameron, and Mr. Sharpe, I divided the tendon of the external rectus muscle.

The following is an exact account of the movements of both eyes after the operation :—

As soon as the division of the tendon of the external rectus muscle was completed, the eye occupied the axis of the orbit ; when the patient moved the sound eye to its fullest extent outwards, the eye operated upon occupied the inner canthus, but did not turn so deep as it does when both eyes are unaffected ; in this respect the same phenomena presented themselves as when the inner rectus muscle is divided for convergent strabismus of one eye.

The strabismus in this case must have been owing to weakness of the internal rectus muscle, or, perhaps, total or partial paralysis of it ; otherwise there was nothing to prevent the eye from being turned deeply inwards, so as partially to conceal the cornea, and the oblique muscles were capable of producing the inward movement which took place.

August 16th.—There is no appearance of strabismus. A small granulation has sprung up in the incision of the conjunctiva, which I removed with a hook and flat pair of scissors.

VARIETIES OF STRABISMUS.

Other forms of strabismus, besides the convergent and divergent kinds, are extremely rare. As they, for the most part, depend upon the existence of tumors, cicatrices, &c., in the vicinity of the orbit to which the eye is constantly being turned, the direction it will take will necessarily depend upon the situation in which the attractive object is placed.

It is not necessary to dwell further on these varieties than to observe that it does not always happen that the eye is directed towards the object in the vicinity of the orbit, but from it.

I have seen two patients, the one with a cicatrix on the outer side of the cheek, and the other with a nævus on the outer part of the upper eye-lid ; both squinted, but the eyes were turned inwards. In these cases the deformities existed long before the squint ; in that with the cicatrix, the burn which caused it occurred at the age of seventeen, and the squint followed a year after the healing process was perfected.

ON THE TREATMENT OF STRABISMUS.

The treatment of strabismus resolves itself into one of two kinds—viz., constitutional and local, and occasionally into both.

Before proceeding to adopt any method of treatment, it is of the first importance that the causes upon which the strabismus depends be anxiously enquired into, and this more especially in children.

The new operation, it should be borne in mind, is not applicable to every form of strabismus ; innumerable cases present themselves where it is inadmissible, or which can be cured by milder measures ; and the surgeon who operates without first investigating the history of the case, and accurately ascertaining the amount of deformity which exists, is guilty towards his patient, on the one hand, of inexcusable rashness, and towards his profession, on the other, of bringing a safe and efficacious operation into unmerited disrepute.

The novelty of an operation, together with its simplicity and safety, too frequently induce a thoughtless application of it, regardless of the after consequences.

Two cases presented themselves to me some months ago, to be operated upon for convergent strabismus. On examining the condition of the eyes, one cornea in each was found to be densely opaque; in one case for half its circumference, in the other for a smaller extent. Both squints were consecutive upon the opacities, and evidently took place for the purpose of allowing the rays of light to pass through the transparent portions of the cornea.

Mr. Pettigrew, Dr. Hennis Green, Dr. W. Pettigrew, Mr. Cameron, and others who were present, agreed that it would be rash to interfere with this wise provision of nature, to secure vision to the organ by operation, the effect of which would be to straighten the eye, and counteract her obvious intentions.

One of these patients has since been operated upon elsewhere, and I had an opportunity some days since of seeing his eye straight and useless!

That many cases of strabismus which depend upon atrophy or hypertrophy of a muscle, can be cured by other means besides operation, the records of surgery afford abundant evidence. Within the last six months I have met adults who, when children, were the subjects of strabismus, and who wore various mechanical contrivances by which they were cured; and I have met others who were subjected to a similar treatment in which the strabismus was very much corrected.

In cases of strabismus, where no previous disease or accident occurred to which the affection could be attributed, and where there is no disparity in the vision of both eyes, it may be inferred that the cause of the deformity exists in the muscles themselves; and such cases require the most serious reflection regarding the propriety of an operation, or the adoption of other treatment. In children this deliberation is especially called for. The muscles of the eye, in common with all the other parts of the body, are at this time being developed, and by frequently calling into action the weaker muscle by a well regulated amount of exercise, there is every reason to expect, and experience proves it, that after a time it will acquire its proper magnitude and healthy amount of power.

There are no organs in the body whose size and power can be increased and regulated in a greater degree, by well directed exercise, than the muscles. The history of gymnastics, the correction of deformities by bringing muscular action into play, as in crooked spine; and the well-known treatment of Hunter in the case of the patient, the portions of whose fractured patella united at a distance; are a few of the many instances which might be brought forward.

If a muscle of the eye be altered in its structure, such as we find the stern-ocleidomastoid to be in wry neck, any amount of power which the opponent muscles may obtain will have little effect in correcting the strabismus, for in this case the muscle producing the strabismus will be to the eye what inelastic ligament is to the articulations, and an operation for the section of the altered muscle becomes indispensable.

The history of the case, and the power which the patient possesses of turning the affected eye from its unnatural position, will enable the surgeon to form a pretty accurate diagnosis of the condition of the muscle which produces the deformity. Where the patient was capable, under any circumstance, of turning the affected eye external to the axis of the orbit, and especially when he had the power of keeping it in this position for a short time, both eyes being open, I never found any alteration in the structure of the muscle upon dividing it. In some such cases it was more developed than natural, but in others it appeared of its natural size, and I have occasionally even found it pale and very thin. But where the patient had not the power of turning his eye more than a few lines from the inner canthus, and could not retain it for a short moment, even so much outwards, both eyes being open, I as invariably found the muscle altered in its structure, or most unnaturally developed.

CASE XXIII.

Aug. 31, 1840.— Mary Anne Oldsgood, *ætat.* eight, has been the subject of strabismus for the last five years. Her irides are of a light blue colour, and the right eye is turned deeply inwards. When her left eye is closed, she can barely evert the turned in one as far as the centre of the orbit, and cannot retain it so for a few minutes without great difficulty. There is also a slight inclination of the left eye inwards. With the exception of this deformity, she is a fine healthy child, and is most anxious to have the squint removed.

Her parents cannot attribute the strabismus to any satisfactory cause.

Before commencing the operation for the division of the right internal rectus muscle, I remarked to those present, that in all probability the strabismus depended upon some alteration in its structure.

In the presence of Dr. Léon Husson, Mr. Cameron, and Mr. Green, I performed the operation in the usual manner; and when the division of the muscle was being effected its extraordinary development struck every one present. It at least consisted of *three times the natural quantity of muscular and tendinous structure;* and instead of its being inserted in the usual semi-circular manner its tendon was of a rounded form, and grasped the sclerotic coat for a considerable extent. I had to complete its section with a forceps and a pair of curved scissors; and when this was effected, the mark of its insertion was fully the extent of the circumference of a silver fourpence. The muscle was not altered in its structure.

Taking these circumstances into consideration, little hope can be held out of curing convergent strabismus by any means beyond operation, where the patient has only the power of feebly everting the eye; but, on the other hand, the best effects may be anticipated by the use of mechanical contrivances, calculated to exercise the external rectus muscle, in those cases where the patient can evert the organ to a considerable degree, and above all, when he can keep it so for some moments, both eyes at the same time being open.

A description of the various contrivances which have been used for the purpose of exercising the weak muscle is uncalled for; they are all based on the same principle, and consist of either placing an object in a proper position, to which the cornea of the affected eye will be constantly attracted; or of covering the eyes with instruments so contrived that the patient, to see, must turn the cornea in the desired direction.

If an adult patient possesses sufficient perseverance, he has it in his power to correct the strabismus, provided it is dependent upon unequal muscular action, without resorting to mechanical contrivances.

By closing the unaffected eye, he can evert the turned in one, and then, by steadily fixing it on an object, he will be able to retain it in the everted position for some moments, on the other being uncovered. On constantly repeating this experiment the power of everting the affected eye will be more and more increased.

I am acquainted with an adult who became afflicted with convergent strabismus of his left eye at the age of 17, and who, by perseverance in this method of treatment, and binding up the unaffected eye for hours together, has materially alleviated the deformity. Indeed it is only at certain times, particularly when under the influence of mental excitement, that the strabismus becomes very manifest.

When in children strabismus is dependent upon affections of the digestive organs, or when in adults the degree of strabismus is increased from similar causes, the treatment becomes obvious.

I have had already occasion to mention some cases of temporary strabismus in children, dependent upon derangements of the primæ viæ, which have steadily improved as their bowels were brought to act healthily.

Such cases will require constant watching, lest from repeated attacks of temporary strabismus the disease may at last assume the permanent form, and require less manageable remedies for its cure, or ultimately operation.

Strabismus, depending upon the presence of worms in the alimentary canal, is to be promptly treated by the removal of the cause which induces it; and where it depends upon dentition the treatment is equally plain.

Some of the most serious forms of strabismus attend diseases of the brain, and determinations of blood to that organ; but here, unfortunately, the treatment of the strabismus is of very minor importance compared with the treatment of the cause which induces it.

In hydrocephalus strabismus is a common occurrence.

In inflammation of the brain, strabismus is so constantly met with that systematic writers usually describe its forms, when treating of this affection, and attribute its presence to compression, occasioning more or less paralysis of the motor nerves of the eye.*

It is only in cases where the patient recovers from any of these diseases with strabismus, that operation upon the muscles of the eyes, or other treatment, becomes necessary; and the judgment of the practitioner must be guided by the condition of the muscles of the affected eye, their relative amount of power, the intensity of the strabismus, and the length of time which it has existed.

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* Dr. Hope, Library of Medicine, *art.* Inflammation of Brain.

When strabismus in the adult follows determinations of blood to the brain from violent mental emotion, excess in venereal indulgencies, the abuse of spirituous liquors, and other such exciting causes, the affection is under the controul of milder remedies than operation, provided these measures be speedily put into practice, and steadily persevered in.

I have alluded to cases in which the best success followed strict antiphlogistic measures. Such treatment is so familiar, and is so fully detailed in various writings, that it is unnecessary to dwell upon it here; and it also need scarcely be mentioned, that a cautious abstinence from the cause which produced the determination of blood to the brain should be strictly adhered to. I have always observed that where strabismus arose from sudden determinations of blood to the brain, such as follow a paroxysm of hooping-cough, croup, &c., it took place almost instantaneously.

Where strabismus is consecutive on measles, small-pox, and the other exanthemata, there is every reason to attribute it to the effect which these diseases produce upon the conjunctiva, in common with the skin and mucous membranes of the body generally.

Strabismus, in like manner, follows repeated attacks of conjunctivitis.

In such cases the practitioner would be much to blame if he proceeded at once to divide the tendons of any of the ocular muscles, until he tried other remedies.

As the affection of the conjunctiva subsides under the use of collyria and constitutional treatment, the squint will also in most instances disappear. If it should not, there need be no hurry to operate, for the eye can be straightened at any time by this measure.

In those cases, where strabismus arises from imitation, habit, unusual position of the head, and such causes, its treatment resolves itself into removal of the cause which induced the patient to acquire the squint; and the healthy exercise of the muscles in the opposite direction, either by the voluntary power of the patient or by mechanical contrivances.

In like manner the early removal of tumours, nævi, &c., when squint is dependent upon their presence, will prove equally successful; but if these have existed any length of time, the eye, after their removal, will still be frequently directed to the situation they occupied, particularly if the patient be excited.

Strabismus, arising from injuries of the head, are sometimes temporary, and disappear with the other symptoms; it constantly happens, however, that it remains after the other effects of the injury have subsided, and resists all treatment except by operation. The worst forms of strabismus of one eye, and of both, have followed such accidents.

The affections of the eye itself, which are followed by strabismus, are very numerous, and it requires a cautious examination of the history of the case and the condition of both organs before an operation be resorted to.

Where squint arises from nebulous cornea, in many instances it will be benefited or entirely cured by remedies calculated to remove the nebula; such as the administration of mercury, and the use of stimulating collyria. But where the strabismus is dependent upon dense opacities of the cornea, such as follow deep ulcers of it, the less either the strabismus or the opacity is interfered with the better.

I have had two boys under my care for the last three months for temporary strabismus. In one of these there was a slight speck on the cornea of the affected eye, the result of strumous ophthalmia; in the other there was a dense opacity nearly in the centre of the axis of vision, the result of a small-pox pustule. These cases have been treated with small doses of bichloride of mercury night and morning, and the application of vinum opii to the eyes. In the former case, the speck and the strabismus have disappeared, and in the latter the opacity is reduced at its circumference, where no disorganization of the cornea existed, and the strabismus is much less in frequency and intensity.

In those cases of amaurosis, followed by squint, where the natural fullness of the eye and the transparency of the cornea remain, the operation for strabismus with the sole object of improving the appearance of the individual, is admissable. In treating of the causes of this affection, I have given the particulars of a case of this kind. On the other hand, if the globe of the eye does not give its peculiar resisting feel to the fingers,—if it be much softer than the other, if it be smaller and its natural whiteness altered, or if other changes are perceptible in evidence of its disorganization, the operation should not be performed.

When strabismus is accompanied with disparity in the vision of the eyes, the operation is doubly demanded: in the first place, because it will cure the deformity; and in the second, because the vision of the weak and turned eye will almost to a certainty improve, if not become equally strong with its fellow.

In several cases of convergent strabismus of one eye, accompanied with indistinct vision, in which the deformity was cured by the operation, I have been unexpectedly gratified to learn from the patients by letter, that the vision of the weak eye steadily and progressively amended. In other cases, it is right to notice, no improvement in vision took place, but these were fewer than the former.

ON THE MODE OF PERFORMING THE OPERATION FOR THE DIVISION OF THE INTERNAL RECTUS MUSCLE OF THE HUMAN EYE.

In all varieties of convergent strabismus, whether one or both eyes are affected, the patient in general experiences much difficulty in everting the turned in organ from the unnatural situation in which it is placed, if the opposite eye be allowed to remain open; on the contrary, if one eye be closed, the turned in one can readily be everted to a degree, varying of course with the intensity of the strabismus, but always more or less sufficient to materially facilitate the future steps of the operation.

In examining the eye of a patient, who is the subject of strabismus convergent, if the hand be placed on the unaffected eye this fact can at once be ascertained, and the patient will be found not only to be capable of everting the turned in eye, but, in many instances, of retaining it so for a minute or two without much effort; the moment, however, that the sound eye is uncovered, the other almost as immediately turns in.

Taking advantage of these facts, I was led to bind up the unaffected eye before proceeding to operate, and in those cases where both eyes were affected, I found equal advantage by a similar proceeding. A silk pocket handkerchief is probably the best material for this purpose; it is pliable, soft to the skin, and is easily adapted to the shape of the head; it is also more acceptable to the feelings of the patient than an ordinary bandage, having less the appearance of a surgical apparatus. A pad of soft lint should be first placed over the eye, sufficiently thick to be on a level with the margins of the orbit, which will prevent the handkerchief slipping.

The next step before commencing the operation is the selection of a proper light. The patient should be placed before a window, or, what is better, if the day admits of it, the window may be allowed open ; a bright light should be avoided, as it is distressing to the eye, more particularly if circumstances arise during the operation which oblige the surgeon to prolong it, and a moderately clear light answers all purposes.

So much depends upon the degree of firmness a patient possesses, that it is impossible to lay down directions for any one position which will be applicable to all cases. When the patient displays a moderate share of fortitude, has power over his eye to evert it when desired, and to keep it so for some moments, and is willing and able to assist the operator to his utmost, all of which can be ascertained before commencing the operation, I have found a cushioned chair, with the back low enough to allow the head to recline moderately, the best contrivance to place the patient in. In a few cases, however, where the patients were children and unruly, other contrivances were obliged to be had recourse to, such as placing the child in the lap of an assistant, who secured its legs by grasping them between his thighs, whilst the head of the child was allowed to recline on his right breast, and was secured against it by means of his right arm.

In one case, a girl nine years old, it was even necessary to place her on her back upon a table, and, with the aid of those present, to secure her in this position until the operation was accomplished. When the patient is young, and apt to offer resistance, I now invariably bind the arms to the sides with a common bandage.

It should not be inferred from these statements that the operation is one by any means painful ; on the contrary, I do not know any operation of equal importance in surgery which is less so. The majority of the patients I have operated upon complained more of a sense of uneasiness than of actual pain, and one remarked, after it was completed, that it appeared to him as if what he had undergone were preliminary steps to the operation itself.

In consequence of the eye being an organ exquisitely sensitive to slight irritants, an idea is very popular that it cannot sustain injuries equally well with other parts of the body, and that operations upon it are attended with much greater pain than upon other organs; but this opinion is totally opposed to practical observation. There is no organ in the human body which bears operations better, or one in which the pathologist can better observe the steps which nature takes in repairing injuries, whether accidentally or designedly committed upon it.

CASE XXIV.

Mr. C—— Y——, *ætat.* 24, consulted me about his right eye, which had been inverted since he was three years old. I explained to him the nature of the operation, and that I had no doubt it would prove most successful in his case.

It was agreed that he should submit to the operation the following morning at eleven o'clock, at which time he attended for that purpose. But, notwithstanding his full determination to have it performed, added to my own entreaties, in which a full half hour was consumed, he could not bring himself to submit, on account of the great pain which he imagined would necessarily attend it. He left my house, and promised to attend again the same day at four o'clock, about which I confess I was a little sceptical, but with the hour arrived also Mr. ——, who submitted without any persuasion to the operation, and expressed his surprise, after it was over, at the trifling degree of "uneasiness, for he could not call it pain," which he experienced.

The result of this case was most satisfactory; the healing process went on uninterrupted by inflammation, or any other unpleasant circumstance, and he left town with his eye perfectly straight.

The patient, then, being properly adjusted, and, if necessary, secured, the position which the assistants are to hold to him, and the operator is next to be considered. In general, where the patient is not unruly, two assistants will answer all purposes—or, indeed, one will suffice, as the principal use of the second is to hand the instruments when required, a proceeding which may be dispensed with if the operator arranges his instruments before-hand on a small table within his reach. The principal assistant stands behind the patient, and should be sufficiently raised above him to have full command over his head and eye-lids. The head of the patient should be allowed to rest against the lower part of the assistant's chest, and at the same time that he is securing the eye-lids, he is thus also enabled to steady the patient's head.

To effect the former purpose, the best instruments are the fingers of the assistant. I am aware that several inventions have been contrived for the same purpose, such as the wire speculum, the solid speculum, the blunt retractors, and so on; and of late that a forceps has been used which is made to grasp the conjunctiva, and is allowed to hang from this delicate membrane, with the professed view of depressing the lower eye-lid by its weight.

A more clumsy or a more unnecessary proceeding than this could not have been devised; unnecessary, because the finger, as every one knows, is sufficient to depress the lower lid for all practical purposes better than any instrument; and clumsy, on account of the continued drag which a heavy forceps must make upon the tunica conjunctiva, and its being apt to let go its hold during the operation.*

By using the fingers in securing the eye-lids a double object is attained. In the first place the natural softness and temperature of the fingers when applied to the delicate tegumentary covering of the eye-lids, never produces that degree of irritability in their orbicularis muscle, which contrivances of human invention in general do; and, in the second place, when these natural retractors are judiciously applied, they are always sufficient to keep the lids apart, to regulate the degree of separation required, and to allow them to close when it is desirable that they should do so, better than a speculum, a forceps, or any other such clumsy inventions for this purpose.

Supposing that it is the right eye which is the subject of operation, the assistant who supports the patient's head should place the fore-finger of his right hand on the integuments covering the malar bone near its junction with the superior maxillary, a few lines beneath the lid, and should draw them downwards and a little outwards, not with a great degree of force, as is sometimes done, but gently: if too much force be used, the conjunctiva, as it passes off the globe of the eye to the eye-lid, and the tarsal cartilage become everted and swollen, and more or less conceal the globe.

The fore-finger of the left hand should be employed in elevating the upper lid, the integuments of which should be gently raised towards the supra-orbital ridge, and there steadily compressed against it. This should be performed three or four times before commencing the operation, as it accustoms the patient to it, and lessens the chance of his offering unintentional opposition by the contraction of the orbicularis muscle. The operator also, before commencing the section of the conjunctiva, will find it advantageous to touch this membrane, where it covers the inner rectus muscle, three or four times with the handle of his hook, or the point of his finger, with the same object.

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* As well might a heavy weight be appended by a dentist to the lower lip, for the purpose of opening the mouth.

These observations may appear to some of my readers of but trifling importance, but it should be remembered that I am not treating of an operation which involves one-sixth of the human body, as amputation at the hip joint, or the removal of the facial bones by a chisel and mallet, or forceps; where, in either case, the resistance offered by the sufferer to the surgeon is not of much moment as regards the immediate object of the operation, and can be overcome by physical force; but that I am describing an operation which has for its object the division of the tendon of a muscle which is so allied at its insertion to the sclerotic coat of the eye, that it may be said to form a part and parcel of that membrane, and a wound of which may be followed by serious consequences; even to the evacuation of the humours of the eye, and the total loss of the organ. In all operations upon the eye, moreover, the surgeon has to contend against a moveable eye-ball, and the voluntary and involuntary contractions of the orbicularis muscle, and the space he is to operate in is very limited, and more or less deepened by the prominences of bone which form the natural defences to the contents of the orbit.

The patient being thus prepared, and the eye-lids held apart, the operator commences to make the required section of the conjunctiva. In some of my early operations I accomplished this purpose with a forceps and a narrow-bladed, sharp-pointed knife ; but further experience has shown me that it can be better and more quickly performed by means of the sharp-pointed hook, and a common sharp-pointed pair of scissors, than by any other instruments.

The forceps is apt to let go its hold of the conjunctiva, and pinching this membrane always induces a considerable degree of pain, which the punctures made by the hook never do.

By having the hook fixed in a cedar handle, a great degree of lightness is given to the instrument, so that if the patient should start suddenly, or in any other way struggle so as to interfere with the operation, the operator may let go the instrument, while it is yet fixed in the conjunctiva, without doing injury to this membrane, endangering the eye itself, or losing its hold. In three or four operations in which the patients struggled, I found the advantage of this precaution.

The operator takes the hook in his right hand, and inserts it into the tunica conjunctiva, about two lines or two lines and a half distant from the cornea, and on a line corresponding to its transverse axis. He then transfers the hook to his left hand, and taking in his right the sharp-pointed scissors, he first gently draws forward the conjunctiva, and makes a semi-circular incision of this membrane, from below upwards, upon the outer side of the hook, to an extent varying from four to six lines. It may sometimes even be desirable to make the incision longer. If the patient feels faint at this time, or if he gets pale, the hæmorrhage from the incision of the conjunctiva will hardly amount to more than a drop of blood ; indeed, in two cases where the patient felt faint, there was not, during the entire operation, as much blood as would soil a white handkerchief; but two hours after the operation, when the system re-acted, three or four drops of blood escaped from the incision.

In the majority of cases, however, the hæmorrhage will amount to some eight or ten drops, which will interfere more or less with the future steps of the operation. When this occurs the operation had better be suspended for a moment or two, and the blood be removed by means of a fine sponge and tepid water, when the bleeding will soon cease.

The advantages which obtain from making the section of the conjunctiva nearer to the cornea, in preference to the plica semilunaris and lachrymal caruncle, are that the membrane is less vascular in the former situation, and the chances of hæmorrhage are diminished in consequence—that the lachrymal apparatus at the inner canthus of the eye is thus protected from immediate injury, or the remote ill consequences of inflammation, should it supervene, that the tendon of the inner rectus muscle is as readily got at in the one situation as in the other, and that the mark of the incision, some weeks after the operation, is scarcely perceptible.

When the required section of the conjunctiva is made the fine sharp-pointed hook should be withdrawn, the eye-lids be permitted to meet, and the further progress of the operation be suspended for a few moments; during which time, if there be any hæmorrhage, the sponge and tepid water are to be used; indeed, whether there be hæmorrhage or not, the application of tepid water is always agreeable to the patient. The eye-lids are next to be carefully wiped dry with a handkerchief, and the assistant is to secure them as before, when the lips of the incision of the conjunctiva will be found to be more or less separated from each other. The operator then takes the blunt hook in his right hand, and, inserting it between the edges of the divided conjunctiva, he insinuates it from below upwards, between the tendon of the muscle and the sclerotica. This being effected, either totally or partially, the eye-ball and the muscle are at the complete command of the operator.

It sometimes happens that upon exposing the incision of the conjunctiva its edges will be found raised in consequence of the blood insinuating itself in the cellular tissue; if this should offer any difficulty to the introduction of the blunt hook, the lids had better be again closed, and slight pressure be made upon them with the finger over the incision, which will have the effect of displacing the effused fluid. It is very seldom, however, that this effusion takes place, unless the conjunctiva be needlessly pulled or torn.

The cellular tissue immediately behind the conjunctiva and the sub-conjunctival and sub-muscular fasciæ, often afford resistance to the passage of the blunt hook. The former can be easily separated with the point of the instrument, and the fasciæ also, but with more difficulty.

The blunt hook being inserted beneath the muscle, the operator transfers it to his left hand, and having brought the tendon into view, he divides it with a sharp pointed pair of scissors held in his right hand, as close to its insertion as is compatible with the safety of the sclerotica.

The further proceedings of the operation are simple. If the eye be not immediately everted, or if the patient has the power of turning it so far inwards as to conceal any portion of the cornea, or to hide completely the *white of the eye* between the cornea and the inner canthus, in all probability some of the tendinous fibres of the muscle have not been divided. To ascertain if this be the case, I have found the blunt hook the best instrument; it should again be inserted between the edges of the incision of the conjunctiva, and by directing its point upwards and downwards, keeping it at the same time close to the sclerotica, the most minute tendinous filament, if undivided, can be detected, and its section accomplished.

Notwithstanding that the muscle be divided in the most satisfactory manner, and even a portion of it cut away, the eye in many cases will be found still inverted. I have ascertained beyond all doubt that this inversion is owing to the condition of the sub-muscular and sub-conjunctival fasciæ. When the inner rectus muscle is fairly divided, the mark of its semi-circular insertion, with minute fuzzy tendinous fibres adhering to it, are as plainly discernible to the naked eye as the scissors with which the operation is performed; the inversion of the eye therefore cannot in such cases be owing to the inner rectus muscle: but if the sub-muscular and sub-conjunctival fasciæ be examined, they will be found strong and dense, and upon freely dividing them, both upwards and downwards, with a forceps and a pair of scissors, the eye in most cases will become perfectly straight. I say in most cases, because it sometimes happens that these fasciæ are intimately adherent to the sclerotic coat for its inner extent, and the operator will be obliged to dissect them from it leaving the sclerotic coat completely bare. I have had to do this in ten or a dozen cases, and the eye afterwards took the desired position, without the slightest bad consequence following the operations. When this unnatural adhesion of the fasciæ was present I have invariably remarked that the conjunctiva, upon making its section, was not connected to the parts beneath it in the very loose and delicate manner it is in the perfect condition of the eye, but that it was thicker than natural, and could not be raised freely with the sharp hook. At first I thought that in inserting the sharp hook I might have gone too deep, and I withdrew it, but upon again inserting it into the conjunctiva I found this membrane in the state I have described, and had afterwards to separate it freely, before the other steps of the operation could be proceeded with. When this condition of the conjunctiva exists the operator may be prepared for a similar condition of the cellular tissue and fasciæ beneath it; and for a tedious operation, in comparison with that where the conjunctiva is loose and moveable, and the other parts in a similar state.*

In describing this operation I have purposely avoided speaking of any contrivances to fix the eye, for in almost every case I have operated upon, I found no necessity for such instruments. Provided the patient can evert his eye when the other is closed—and, except in the most extreme cases of convergent strabismus, he can do so—this is all that is necessary; he can keep it so sufficiently long to enable the slowest operator to insert the sharp hook into the conjunctiva, and when once this is accomplished its section is easy. Occasionally the eye will at this time turn in; but this is of no consequence, the operator has only to wait a moment or two, and with the assistance of the hook and the patient, the eye can readily be turned sufficiently out to enable him to make the necessary section of the conjunctiva. This being effected, the blunt hook can be readily passed under the muscle, and then, as has been already remarked, the eye and the muscle are under our perfect control.

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* In no case was the development of the subconjunctival and submuscular fasciæ, and the adherence of the conjunctiva more remarkable than in that of Sir —— C——, Bart. After the hook was inserted into the conjunctiva, I had to dissect this membrane from the subjacent parts, and when the inner rectus muscle was clearly divided, the eye still had an inclination inwards. It was not until both these fasciæ were dissected from the inner circumference of the sclerotica that the eye became perfectly straight.

For many months Sir — C— persevered in the use of electricity and strong collyria, which were prescribed for the cure of the strabismus, and which applications doubtless kept up a degree of vascular excitement in the parts, tantamount to subacute inflammation, and induced the changes of structure and the adhesions of the conjunctiva which were presented during the operation.

If the other structures require to be divided, a forceps and a pair of scissors are the best instruments, and the more movable the eye is during these being divided, the easier they are got at, and their division completed.

If the insertion of hooks into the sclerotic coat of the eye can be avoided, the better ; it is impossible to regulate the depth to which such instruments may penetrate, if its curve be too great, and if the turn of its sharp point be only sufficient to penetrate the conjunctiva, and the parts beneath it, without entering the sclerotic coat, the instrument will be apt to slip during the most critical steps of the operation ; or, to compel it to keep its hold, it must be pressed with force against the ball of the eye, bulging, as it were, the globular sclerotic.

Besides, if the coats of the eye were of the same density and strength at all ages and in all individuals, a hook might be contrived to penetrate a certain distance, and no farther ; but, as these textures are subject to much variety, the formation of such an instrument would require some ingenuity.

In a few cases, where the inversion of the eye was very great, and the patients had not the power of everting it to a sufficient degree, some instrument was required to turn the eye forcibly outwards, and to keep it so until the section of the conjunctiva was made. I found the simple sharp hook quite sufficient to effect these objects.

Some cases of strabismus will occasionally present themselves in which, from the natural conformation of the orbits and their contents, the operation is inadmissible.

In speaking of these cavities at page 6, I gave, in a note, an instance of a malformation of this kind. Since that note was written I have met with three other similar cases. The orbits were small, close set to each other, and directed forwards; their bases were raised considerably, and the distance from one external angular process to the other was very small. The eyes were small and sunken, and their axes were directed inwards; the affected eye much more so, but not to that extent which I have seen in other cases where this conformation of the orbits did not exist.

I refused to operate in two of these cases; in the third, at the solicitation of the patient, I did so, and, notwithstanding that I clearly divided the internal rectus muscle, and even laid bare the sclerotica, for all its inner circumference, the movements of the eyes after the operation were not in unison; when the unaffected eye was covered, the patient could turn the other fully outwards, but the moment both eyes were open it inclined inwards, not to anything like the extent it did before the operation, but yet sufficient to give a squint. It was quite apparent in this case that the external rectus muscle was healthy, and enjoyed unrestricted action, but from the disposition of the axis of the orbit, and the axis of the eye itself, the moment the muscle relaxed the eye took its quiescent position—viz., inwards.

On looking over an interesting work on Amaurosis, lately published, I find the following note at page 347 *:—" Professor Rossi has invariably found the " orbit more oblique than usual in persons who are " affected during life with congenital strabismus, its " central axis not being perpendicular to its base. From " these observations he concludes that simply directing " the process of ossification would in many instances be " sufficient to remove congenital strabismus. He re-

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* A Treatise on Amaurosis, by Edward Octavius Hocken, 1840.

"commends glasses which are flat, and as large as the "base of the orbit, covered with black varnish, to be "used, where the strabismus depends on irregular mus- "cular action, having a transparent portion in the "centre of a conical form, consisting of a horizontal "and an oblique line, the latter being small on the side "towards which the eye is morbidly directed, and larger "on the other, the globe turning towards the side "where the light is most considerable, and thus gradu- "ally correcting the abnormal direction."—*Memoirs of the Academy of Sciences at Turin.*

When the operation is completed, I have always covered the eye with a double fold of old linen or lint suspended from a tape tied round the forehead, and have directed the patient to keep it moist, with either cold or tepid water, whichever was most agreeable to his feelings. I have also, as a matter of precaution, directed some James's powder and calomel to be taken at bed time, and to be followed in the morning by some aperient medicine.

ON THE REPARATIVE PROCESS AFTER OPERATION.

The method which nature repairs the injuries done to the textures in the performance of the operation for dividing the muscles of the eye, are too interesting, and involve too many points of practical importance, to be passed over in silence.

In no case did the incision of the conjunctiva heal by the slightest approach to *immediate union;*[*] on the contrary, in the most favourable operation, the edges of the incision of the conjunctiva were fully a line distant from each other, and in the majority of them they were even more distant than this.

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[*] Vide, a Treatise on Inflammation, by James Macartney, p. 48.

When the circumstances under which immediate union is effected are considered, the reasons why it does not take place in the wound made in the conjunctiva become obvious. To effect immediate union of a wound, it is necessary that its edges be brought into perfect contact, and retained thus for some hours at all events, care being taken at the same time that no blood be allowed to intervene between the divided parts; cuts of the integuments of the fingers heal when thus treated in a very short time.

In the case of the conjunctiva, however, the surgeon is denied the power of bringing its edges together by bandages, adhesive plasters, and such contrivances; and the globular form of the organ which it covers, together with its connection to the eye-lids, and the continual movements of them and the eye-ball, favour the separation of the edges of an incision made into it.

At the end of thirty-six or forty-eight hours after the operation, the conjunctiva becomes very vascular in the vicinity of the incision, in some cases more so than in others; the edges of the divided conjunctiva become slightly swollen, and occasionally partial chemoses occur, which are caused by the rupture of the distended vessels, and which are independent of any blood which might have escaped into the sub-conjunctival cellular tissue during the operation.

The most usual situation for chemosis to occur is beneath the conjunctiva, covering the inferior rectus and inferior oblique muscles, and at a later period in the conjunctiva, covering the external rectus muscle. In this latter situation I have known, in several instances, the chemosis to occur at the end of ten or twelve days after the operation; and an intelligent patient, on whom I operated, and who took great interest in the history and nature of strabismus, having had chemosis in this situation, at the end of eight days wrote me a letter, asking "if it might not have arisen from the increased contraction of the external rectus muscle rupturing some small blood-vessels?"

As soon as the vascularity of the conjunctiva and the slight thickening of its edges occur, effusion of lymph takes place slowly and steadily, unless some untoward accident occurs, such as the supervention of inflammation, when the steps towards reparation are retarded.

In the most favorable cases, four or five days elapse before the sclerotic coat, which is always to be seen between the lips of the incision of the conjunctiva, is hid.

Where the required quantity of lymph is effused, its organization proceeds rapidly, and at the end of a period, varying from three weeks to a month, the vascularity subsides, and a slight cicatrix remains, which disappears ultimately.*

The conjunctiva in a few cases was movable over the sclerotic coat in the site of the cicatrix, but in the majority both membranes were adherent in this situation.

The muscle, upon its tendon being fairly divided, retreats within the orbit, and afterwards unites firmly to some part of the sclerotic coat. In six cases in which I had to operate a second time, I ascertained this to be the fact. The new adhesion is powerfully strong, and of a rounded form, differing in these respects from the natural insertion of the muscle. From the tenth to the fourteenth day after the operation the muscle is capable of performing its specific action, and if it should happen that it adheres to the sclerotica too much forwards, it will again give the eye an inclination inwards, but never to the same degree which the eye had before the muscle was divided.

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* I removed, some weeks since, a fatty pterygium, which, from its increasing in size, gave the patient much uneasiness. The manner in which the wound of the conjunctiva healed was precisely similar to that I have just described.

In the cases where the muscle united to the sclerotica, and again drew the eye inwards, there was a good deal of hæmorrhage when it was divided in the first instance, and it was unusually developed.

It occasionally happens that the healing process does not proceed so satisfactorily as has just been described, and at the end of eight or ten days granulations shoot from the sub-conjunctival cellular tissue, and rise between the edges of the divided conjunctiva.

In such cases the vascularity of the conjunctiva and the effusion of lymph are more excessive, although the patient suffers no pain in the eye.

I have observed these granulations most frequently to take place in children, particularly when they struggled much and the operation was prolonged; they are close set, flat, shining, and of a pale red colour, and seldom give more than a sense of uneasiness to the patient. The best way to treat them is to snip them off with a pair of scissors, curved on the flat.

Inflammation after the operation is a very rare occurrence. When it does take place, it is accompanied with effusion into the cellular tissue of the eye-lids, pain referable to the inner angle of the eye, and slight purulent discharge. It is easily subdued, and the reparative process afterwards continues to proceed as if inflammation had not supervened.

A case has been communicated to me, in which abscess within the orbit followed the operation. I cannot speak from my own experience on this subject, but I can conceive such a consequence to follow from great violence being inflicted on the parts during the operation; such as unnecessarily tearing the cellular tissue and fasciæ, poking instruments into the orbit after the division of the muscle, and similar proceedings. When such a circumstance unfortunately occurs, our duty will of course be to give exit to the matter as speedily as possible, or worse consequences will ensue to the eye than squint.

ON THE CAUSES OF FAILURE OF THE OPERATION FOR CONVERGENT STRABISMUS.

Notwithstanding that the inner rectus muscle be completely divided in this operation, and that the eye for many days will be perfectly straight, and will follow with regularity the movements of its fellow, it will in some cases happen that the organ will again incline inwards, but to nothing like the extent it did before the muscle was divided.

I have beyond all doubt ascertained that this second inversion arises from the muscle forming new adhesions to the tunica sclerotica, and that those adhesions were anterior to the transverse axis of the eye-ball.

In those cases where I had to operate a second time, my professional friends who were present, as well as myself, saw the mark of the original attachment of the muscle, and a little behind this point its new attachment; on dividing which the eye again became straight, and remained so.

In no case were these phenomena better seen than in that of Mr. Mills, whose case is marked XX. After simply dividing the inner rectus muscle of the right eye, the organ became straight and remained so, to the full satisfaction of all who were present.

Five days after, I divided the inner rectus muscle of the left eye, when both organs were equally straight and prominent, and moved in harmony with each other.

These conditions of the organs continued for twelve or fourteen days, when the right eye began to turn in slightly, and as we were anxious to ascertain how far the patient, by the voluntary and constant exercise of the external rectus muscle, could counteract this tendency to inversion, it was decided not to operate for some time longer.

On the 4th of August, 1840, fifty-three days having been allowed to intervene since the inner rectus muscle of the right eye was divided, the organ was still turned slightly upwards and inwards ; and, as little hope could be entertained of this deformity being remedied by counteracting muscular power, I operated a second time, and separated the muscle from its new adhesion.

As the most skilful operator may have occasion to look for the inner rectus muscle under the circumstance just stated, and as some peculiarities present themselves in operating a second time on the same muscle, I shall offer no apology for detailing the manner in which I performed the operation on Mr. Mills.

On exposing the eye, the cicatrix of the conjunctiva was plainly discernible, notwithstanding its being colourless, and was adherent to the subjacent sclerotic coat, I inserted the small sharp-pointed hook about a line distant from its inner side, and here the conjunctiva was moveable over the sclerotica, but not so much so as in its natural condition; with the sharp-pointed scissors I made the requisite section of the conjunctiva, and having removed the blood with a sponge, the inner surface of the sclerotic coat immediately presented itself, in consequence of the cellular tissue and the subconjunctival and submuscular fasciæ not being regenerated since the first operation. The semicircular mark of the original insertion of the muscle was plainly discernible, and taking the blunt hook in my right hand, with the greatest facility I passed it beneath the new insertion of the muscle, which was about a line and a half behind its original attachment. I then gently drew forwards the muscle, and divided it with a scissors as before. The eye immediately took the desired position, and at this moment, September 1st, it would be impossible to detect the slightest trace of strabismus in either eye.

The re-adherence of a muscle after its division to an unfavourable point of the sclerotica, can, as I have already said, be best guarded against by excising a portion of it, and this proceeding is particularly called for where the muscle is unusually developed. Even taking this precaution, should the eye again slightly turn inwards, the muscle can with safety be again reached and divided.

If the subconjunctival and submuscular fasciæ be unusually strong and tense, as they often are, and if the operator fails not to divide them freely, so as to relieve the eye from their operation, the squint will remain only partially remedied. I have repeatedly had occasion to divide these fasciæ after having previously divided the muscle, and the best instruments for this purpose are a forceps and scissors. An inexperienced operator might readily mistake the fasciæ for the tunica conjunctiva itself, but the tunica conjunctiva is endowed with a degree of sensibility which is entirely wanting in these fasciæ, a fact which is clearly shown by laying hold of one and the other with the forceps. When the fasciæ are seized, and are being divided, the patient suffers no pain or inconvenience, but the moment one of the edges of the divided conjunctiva is thus treated the patient winces.

Another cause of failure arises from the fasciæ being intimately adherent to the sclerotica, so that, notwithstanding their being divided, they will still have the power of keeping the eye slightly inverted; to prevent which the only means the operator possesses is to dissect them freely from the sclerotica, which can also be effected with little difficulty by means of the forceps and scissors. When this is accomplished the eye becomes straight.

I do not believe that any of the other muscles of the eye have the power of producing convergent strabismus, hence I should hesitate in either dividing them myself, or recommending others to do so. Having read, in the *Medical Gazette*, that the best results followed the division of the superior oblique muscle in a case where the strabismus was not relieved by the division of the inner rectus muscle, I was induced to do so in one instance without the slightest perceptible advantage being derived by its section. My friend, Mr. Calder, of the 2nd regiment of Life Guards, informs me that he also divided the tendon of the superior oblique muscle with no advantage. I apprehended that in those cases, where the eye is said to become straight upon the division of the superior oblique muscle, that the cause of the inversion remaining, arises from the superior fibres of the inner rectus muscle not having been divided in the first instance, and this apprehension, indeed, amounts to a certainty, when the action of the superior oblique muscle of the eye be considered, for, no matter what differences of opinion exist among physiologists, as to the superior oblique muscle having power to draw the eye forwards, yet all are agreed that its individual action is to turn the eye *outwards*.

If any advantage could obtain from the division of other muscles for the cure of convergent strabismus besides the internal rectus, the division of the inferior oblique appears to offer the greatest, for one of its actions is unquestionably to turn the eye inwards. As for dividing the inferior or superior rectus muscle, or both, the objections are too palpable to require further notice; and the division of the inner fibres of these muscles only will not prevent their again uniting at their original insertions to the sclerotica, on account of the greater part of each muscle being left undivided.

In the performance of this operation, if the parts be roughly handled by unnecessary and clumsy instruments, or if a portion of the conjunctiva be cut away, at the time when the process of cicatrization is being effected, the eye may again turn inwards, owing to the mechanical effect produced by the contraction of the parts.

I have already mentioned the peculiar conformation of the orbits which prohibit the operation.

ON THE EFFECTS OF THE OPERATION ON VISION.

To ascertain the effects of this operation on the eyes, considered as organs of vision, I have, wherever an opportunity presented itself, solicited the patient to inform me by letter of the result of the operation; and where the patients were unable to give me the desired information after this manner, I endeavoured to obtain it by other means.

As only five months have elapsed since I performed the first operation for strabismus, any account of the changes effected in the vision of the patients must be more or less imperfect, as in some the sight is still progressively improving. I shall, however, append some extracts from letters which I have received, and from my notes which bear upon this interesting question.

Sept. 1st, 1840.—W—— G——, Esq., called upon me this day. On referring to my notes, I find that three months have elapsed since the operation was performed, and that he scarcely had any sight in the inverted eye, and was subject to muscæ volitantes.

Both eyes are perfectly straight. Mr. G——'s vision is as imperfect as ever in the eye that was affected with strabismus; but he has not, since the operation, been troubled with muscæ volitantes.

W. H. M——, Esq., was operated on, for inversion of his right eye, June 13, 1840. Three days after the operation Mr. M. thus writes:—

"I can move my eyes without much uneasiness or "pain in various directions; and void of the contrac-"tion I formerly experienced in the eye operated upon. "When crossing or turning the corner of a street ob-"jects seemed as if double; directing my attention "steadily upon any object on my left side, it appeared "as if a looking-glass were placed sideways, or at right "angles, in which I saw the object clearly reflected."

Aug. 25.—Mr. M. called upon me this day; his eyes are perfectly straight, and all the unpleasant sensations he experienced disappeared in five or six days after the operation.

R. W. H——, Esq., was operated on the 5th of May for convergent strabismus of the left eye. On the 28th of May Mr. H. writes as follows:—

"I write now without spectacles, and free from that "unpleasant sensation which I used to experience when "writing or reading, from the presentation of several "objects at once and confusedly to my sight. I can "see somewhat better, too, with the eye operated upon "than before, and am able to turn it freely in all di-"rections."

Aug. 8, 1840.—Jane Lloyd was operated on for strabismus of the left eye six days ago. Before the operation she could see persons with it, but could not distinguish their features. She can now distinguish features with the eye operated on.

Eleanor Cairnes was operated on, July 2nd, 1840, for convergent strabismus of her left eye; since she was ten years old, at which time the inversion took place, she has not been able to read with this organ. July 20th.—She can now distinguish with the eye operated upon, the pattern of the carpet and paper of the room, and can also read small print with it.

Mr. Mills, whose case is given under the head of Converging Strabismus, experienced the following sensations :—

After the first operation the patient saw objects double on two or three occasions.* July 8th, the double vision is now more constant; on this date both eyes had been operated upon; he can keep both eyes open, and apparently direct them to an object without seeing it double; it is evident, however, from the following experiment, that but one of the eyes is employed in viewing it. On desiring him to look with both eyes to an object, and which he appeared to do, I placed my hand between it and his right eye, when he immediately lost sight of the object, although the left eye did not alter its direction. Still keeping my hand over the right eye, I desired him to look at the object with his left, and at the moment of his doing so, the left eye moved slightly inwards.

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* " A gentleman who, from a blow on the head, had one eye distorted, found every object appear double; but, by degrees, the most familiar ones became single, and in time all objects became so, without any amendment of the distortion."—*Cheselden's Anatomy.*

July 11th.—Still Mr. M. sees double, but not to the same extent as before. The "counterfeit" or "second object," appears to him to be at different distances from the real one. He has felt difficulty since the second operation in directing his hands to objects within his reach, but this also has been getting less every day.

Aug. 20.—He can direct his hands to objects with certainty, and the double vision has disappeared.

Mr. W. E—— was operated upon for convergent strabismus of his right eye on June 13th.

Mr. E. thus writes:—" Before the operation, when " the left eye was covered the right eye became straight, " but was almost useless to me; objects appearing very " much smaller and so indistinct that I could not distinguish across a street whether one or more persons were " walking."

" 14th.—Upon looking intently with both eyes, the " confusion and giddiness is very unpleasant; upon " using one eye only the giddiness goes off; at night, " the gas lights increase giddiness."

" 19th.—Quite well; power of vision of cured eye " much more distinct when used alone, but the improvement is not so apparent when both eyes are used, the " cured one not assisting the vision when the object is " more than a few yards distant."

I have selected these cases as bearing more on the effects of this operation upon vision, than any others which I have treated. In no case was the sight of the eye injured by the operation. In many the vision remained as imperfect as before; in some it steadily but gradually improved as the organ was exercised, and in all those where double vision, inability to adapt the eye to distance, or any other disagreeable consequence followed the operation, it disappeared in a few days.

Whilst these pages were at press, Mr. Calder, who has performed several operations for strabismus, and who writes in the most flattering terms of the advantage he derived from the blunt hook, sent me an account of the following case of double convergent strabismus, which presents many points of interest:—

" A rifleman, aged 30, had squinted since he was six " or seven years old. He had this peculiarity in his " squinting that he could do it with either eye at plea-" sure. Generally, however, he squinted with the left " eye; a circumstance which I am inclined to think " was owing to his being so much accustomed to direct " his right forwards in firing. The sight in both eyes " was equally good, an occurrence which I have not " before met with in a squinting individual, the eye " affected with obliquity of vision having in general " very imperfect sight. This peculiarity I suspect must " be attributed to its constant use, and the perfect com-" mand which he had over it. When he looked for-" wards he squinted strongly inwards with the left eye, " but if his attention was directed to a second indivi-" dual, for instance, upon the right of the one imme-" diately before him, so that he was obliged to turn his " eyes but a very little to the left, the left eye (the " squinting one) readily fixed itself in a natural and " proper manner upon the individual, and the right eye " then presented all the characters of a well marked " case of convergent strabismus. This puzzled me much, " and shook my faith in the hopes of a successful ope-" ration. When the peculiarity of his case was men-" tioned to him he said that he constantly observed the " same thing when he was shaving. He stated that the

" left eye was so much under his command that when " he was employed the left side of his face that it be" came straight, and that the right one went entirely " wrong, so as to constitute a perfect squint.

" As the left eye was the one with which he gene" rally squinted, it was selected for the operation. Dr. " White, the Surgeon of the regiment, having the polite" ness and liberality to permit me to operate, I did so in " the usual way, only dividing the muscle much farther " back, more through its fleshy belly than at its tendi" nous termination; no effect followed, the eye remain" ed just as much turned in as before the operation. " In consequence of this, I carefully cleaned the inner " surface of the globe of every thing like cellular tissue, " or tendinous aponeurosis, and likewise divided the " tendon of the superior oblique muscle just where it " approaches the eye to pass beneath the superior rec" tus. I now desisted, and sent the man to bed, " apparently not one whit the better for all this further " proceeding. For the next five days he squinted as " strongly as ever with the left eye, but on the two " following days it was observed to show a disposition " now and then to become straight. In the course of " a few days more the left eye became entirely straight " and remained so; the right eye at the same time be" coming strongly turned inwards.

" I cannot describe his condition after the operation " better than in the words of Dr. White, who in writing " to me some time afterwards, observed, ' you will be " ' glad to hear that the case of the man of ours, upon " ' whom you operated, is not a failure. You may re" ' collect that the left was the eye operated on. Well, " ' this is straight now when he looks at any object, " ' whereas the opposite eye is turned towards the in" ' ner canthus, quite out of the axis of vision. The " ' reverse of this was formerly the case, of which the

" ' man himself is quite aware; and he is now very
" ' desirous of having the operation performed upon the
" ' right eye.' In this suit of the man's the Doctor cor-
" dially joined, assuring me at a subsequent meeting
" that he thought that division of the internal rectus
" of the right eye would complete the cure. Two
" months after the first operation, I particularly ob-
" served that he could not squint with the left eye,
" even when directed to look well to the right; but that
" it appeared natural in all its movements, while the
" strabismus in the right eye was very strong and well
" marked. The operation on the right eye was per-
" formed by Dr. White; and, as I assisted him, I took
" particular notice that he divided merely the tendon of
" the internal rectus. The result was most satisfac-
" tory, both eyes were thus made just as straight as
" eyes generally are; in other words, this second ope-
" ration rendered the cure eminently successful."

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